

December 30, 1963

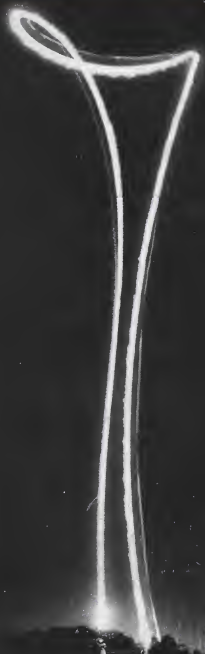
Aviation Week & Space Technology

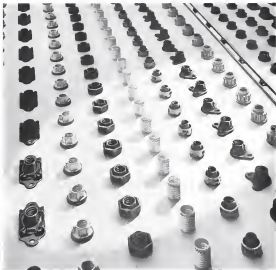
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Scout Failure at Wallops





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 Dielectric-tuned Reflex Klystrons (50U-448D Series in development)	 Dielectric-tuned Reflex Klystrons (50U-448D Series in development)	 Dielectric-tuned Reflex Klystrons (50U-448D Series in development)	 SPERRY ELECTRONIC TUBE DIVISION SPERRY RAND CORPORATION ANN ARBOR MICHIGAN

AEROSPACE CALENDAR

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December 20th, 1960

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the 1990s, and the 1990s have been a period of rapid growth in the number of people who are taking part in the program. The program has been successful in providing a wide range of services to the community, and it has been able to attract a large number of volunteers. The program has been successful in providing a wide range of services to the community, and it has been able to attract a large number of volunteers. The program has been successful in providing a wide range of services to the community, and it has been able to attract a large number of volunteers.

networks, their architectures and design of software to manipulate message streams. We have not yet designed a 2-D video network, but should easily. Furthermore, because of our choice of software, video will be as easy to implement as audio. We will have to design some network layer software, but that can be done by using a few more ideas.

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number 30, 1993



Successful experience...the plus that isn't written into space facility contracts!

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G-2 Muscle and Space Division: Four 6" x 2" component testing chambers regularly attaining pressures in the 10^{-4} Torr range, using 20°K cryopumping.

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STOKES

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AEROSPACE CALENDAR

(Continued from page 5)

vice, Society of Plastics Engineers, Gulf Breeze-Ft. Lauderdale, Florida, 33401.
 Dec. 27—Thermophysical Forum on Atomic Research, University of Illinois, Urbana, Illinois.
 Dec. 28—19th Annual Meeting, American Meteorological Society, University of California, Los Angeles, Calif.

Jan. 20—Solid Propellant Rocket Conference, American Institute of Aeronautics and Astronautics, Palo Alto, Calif.
 Feb. 17—Fifth Annual Lecture in Aerospace Medicine, USAF School of Aerospace Medicine, Brooks AFB, Tex.

Feb. 17—International Conference on Materials, The Impact of Modern Physics on Materials, Statens Hotel, Oslo, Norway.
 Feb. 17—Sponsored American Society for Testing and Materials.

Feb. 17—19th Winter Conference on Military Electronics, Institute of Aeronautics and Astronautics, Anaheim, Calif.

Feb. 17—19th Golden Gate Meeting, American Society for Metals, Paramount Hotel, San Francisco, Calif.

Feb. 19—21—International Solid-State Circuits Conference, Institute of Electrical and Electronics Engineers, University of Pennsylvania, Philadelphia, Pa.

Mar. 1—14—Fifth Conference on Applied Meteorology (Atmospheric Problems of Aerospace Vehicles), Atlantic City, N. J. Sponsors: American Meteorological Society, Federal Aviation Agency.

Mar. 14—Symposium on Thermal Radiation of Solids, San Francisco, Calif. Sponsors: National Bureau of Standards, National Aeronautics and Space Administration, USAF Armstrong Research Div., University of California at Berkeley.

Mar. 14—16—International Testing Conference, Morton Teich, Boston, Mass. (U.S.). Sponsors: American Institute of Aeronautics and Astronautics, U.S. Navy.

Mar. 15—16—International Convention, Institute of Electrical and Electronics Engineers, Conference and New York Hilton, New York, N. Y.

Mar. 21—23—Aerospace Research Conference (London), Granada Hotel, San Antonio, Tex. Sponsors: USAF, Southern Research Institute.

Apr. 12—Fifth Symposium on Engineering Aspects of Magnetohydrodynamics, Institute of Electrical and Electronics Engineers, Massachusetts Institute of Technology, Cambridge, Mass.

Apr. 15—16th Annual Structures and Materials Conference, American Institute of Aeronautics and Astronautics, North Platte, Neb.

Apr. 16—17th Annual Conference on Nonlinear Mechanics, American Institute of Electrical and Electronics Engineers, Sheraton Hotel, Washington, D. C.
 Apr. 24—Symposium on Friction Technology and Lubrication, U. S. Naval Air Facility, El Centro, Calif.
 Sept. 7—11th Power, Design and Safety Conference, British Aircraft Corporation, Farnborough, England.
 Sept. 7—11—19th International Astronautical Congress, Warsaw, Poland.

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PROBLEMATICAL RECREATIONS 203



On what days of the week was the first day of a century felt? (The first day of the twentieth century was Jan. 1, 1901)

—Continued

A new, 8-band electronically tuned klystron has been developed by our Electron Tube division weighing just 23 pounds complete, measuring only 17 inches long. The L4684H is rated at 38 kilowatts peak and 7 kilowatts average in the 250 to 2600 Mc frequency range. You may use one for mobile, airborne, space tracking and communications systems. Contact the Marketing Department, 960 Industrial Road, San Carlos, California.

ANSWER TO LAST WEEK'S PROBLEM: A = 3, B = 7

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DC-8's are the first pure jet freighters. And they carry cargo at fastest speed and lowest cost per ton mile in aviation history.

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DC-7's play a major role in airline freight operations.

C-118's and **C-54's** were the Air Force's workhorses during the Berlin Airlift...showed the

dependability built into Douglas transports.

DC-6A's were the first to break-through the high cost barrier to the expansion of air freight.

C-47's were the mainstays of our World War II military supply effort, flew "the hump" regularly to keep our life-lines to the Far East open.

DC-3's are characteristic of what can be expected of all Douglas transports—more than 2500 commercial and military versions are still flying after 25 years of rugged service.

It all adds up to this conclusion: for transports that perform better, last longer, maintain easier, and stay in there when the going is roughest, you can depend on Douglas.



DOUGLAS BUILDS GREAT TRANSPORTS

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Laurels for 1963

This year in aerospace has been marked by few spectacular public achievements.

It has been a year of intense, grinding work in laboratories, factories and program managers' offices to build the technical foundations for the next generation of aerospace vehicles and missions. This theme will run strong during 1964, with the first fruits of these labors being the launch pads in the 1965-66 period.

In a year of quiet, self-satisfaction these are the people and organizations we think made major contributions to U. S. aerospace progress:

• **Harry Goett, Jack Townsend and Bob Gray** of NASA's Goddard Space Flight Center for its excellent record (900% on eight launches in 1963) of successful satellite launches and operations. This is the second consecutive year that all of Goddard's satellites were successful.

• **Joan Terry Tigges**, president of Pan American World Airways, for his dedication fight to lower international airline fares, particularly on the North Atlantic.

• **Bill Lear**, for having the audacity and vision to successfully launch another that developed the fastest executive jet aircraft and got it flying this year.

• **Allen Donovan** of Aerospace Corp. and **Maj. Gen. Charles Terhune, Jr.**, of USAF Systems Command for their representation and direction of USAF's Project Forcose, which clarified the shape and character of aerospace power for the 1970s.

• **Dr. A. L. Jones** and his associates at the Seleno Research Laboratory in Cleveland for achievements in operating a private satellite tracking station which provides so much solid data on Soviet space flights.

• **Maj. Gen. Ormond J. Rufford**, USAF, for his long and persistent fight to develop a military manned space flight program that now thrives this year in the Manned Orbiting Laboratory program, and for his many prior years of contributions in connection of the atomic bomb flight test group and in supplying of the reconnaissance satellite program.

• **Abraham Scheraga**, Tyco program manager for the Active Electronics Div. of Radio Corp. of America, for his direction of this highly successful weather satellite program culminating in the launch and operation of Tiros 8.

• **Alan S. Reid**, chairman of the Civil Aeronautics Board, for his patience and impartial manner in which he has operated his agency, and for his courage and effectiveness in battling for lower fares on international routes, and protecting the interests of the American air traveler.

• **Glenn Housar** of Convair/Aerovox, **Bill Garton** of Pratt & Whitney Aircraft, **Edmond Jones** of NASA's Lewis Laboratory, and the others on the Gemini project (AV Dec. 9, p. 21) who successfully flew the first liquid hydrogen-powered space vehicle.

• **Reg. Gen. Joseph S. Breyer**, USAF, for his tight and efficient management of the Triton 3 space booster program, which has the excellent co-operation of his two major contractors, Martin Co. Denver Div. and United Technology Corp.

• **Dr. Harold Rosen** of Hughes Aircraft Co., president of Syncom, for his unusual and bold approach to space communications satellites that resulted in the successful operation of the world's first 24-hr. communications satellite, Syncom 2, and to his associates at Hughes, **Donald D. Williams**, orbital control system designer, and **Thomas Hadgouth**, electronics designer, for Syncom.

• **Robert F. Six**, president of General Atomics Air Arms, for providing superb service to air travelers in the repair of turbine engines, and for continuing to do it at a profit in the face of the fierce competition from larger firms as his segment of the transcontinental route.

• **Charles J. Hitch**, Pentagon comptroller, for his reforms in the military budgeting process that have freed the services into more realistic cutting of their weapon systems.

• **Carl Vinson** and **C. E. Woolson**, two fine Georgian gentlemen, who are closing their careers. Rep. Vinson will retire after 30 years in Congress, 15 years of which were spent in outstanding leadership of the House Naval Affairs Committee and 14 years as chairman of the Armed Services Committee. Mr. Woolson, acting president of Delta Air Lines, built it from a crimp during operation to one of the nation's finest and most profitable airlines.

• **Mrs. Betty Miles**, the first woman to solo across the Pacific, completing a 7,400 mi. flight leaving a Papia Airplane from California to Australia.

• **Col. Leslie G. Wooten**, USAF, system program director for the Vela Hotel project that put two nuclear radiation detection satellites into 30,000-mi. circular orbits, 180 deg. apart, with a single launch in the first step in developing a warning capability to detect nuclear weapons testing in space.

• **Rep. George Milne** (D-Tex.) chairman of the House Defense Appropriations Subcommittee, for his tough-minded insistence on getting sound, detailed explanation of U. S. military policy and programs from the ranks of un-elected civilians and glib orators who appear before his group annually.

• **Reg. Gen. Samuel Phillips**, USAF, who, as program director of the Minuteman, was responsible for getting 300 of these solid-fueled ICBMs operational and into the hands of Strategic Air Command.

• **Sen. John L. McClellan** (D-Ark.), chairman of the Senate Permanent Investigations Subcommittee, for his dogged courage in calling the top Pentagon executives back on how they awarded the TFX contract. Sen. McClellan's persistence in pursuing this task uncovered a conflict of interest by former Secretary of Navy Paul Norris, former Defense Secretary Robert McNamara to admit he had not perceived what he perceives as decision making but relied instead on rough judgments, and forced admission from Deputy Defense Secretary Russell L. Gilpatric of his own involvement with General Dynamics as both prior to and during his Pentagon service that he had revealed during initial questioning.

—Robert Hays



Who can give you what you want in transient-free rotary head recorders? AMPEX

Because we did the pioneering work in the advanced area, our engineers have the techniques, know-how and the skill to give you what you want. For example, one customer wanted four magicycle roller recorders with a 40 db signal-to-noise ratio and an absolute time base jitter of less than 50 nsec. He got three. And absolute time base jitter was less than 20 nsec. Another customer needed similar performance in a one cubic foot airborne package. It had to weigh less than 50 pounds. And it had to record two magicycle hours. He got what he



wanted. And reliability is 0.996 for four hour missions. Still another customer asked for several 15.6 magicycle recorders with a 40 db signal-to-noise ratio and a 25 nsec time base stability. He got them—each in a cabinet the size of a single rack. At Ampex, you can get what you want. Need a 10 magicycle recorder? 200 to 1 time base expansion or compression? 10 nsec time base stability? Just come to Ampex. For more information write to Ampex Corporation, Box 6-1, 401 Broadway, Redwood City, California. Worldwide sales and service.



BATURN V, shown in drawing above, will be the first world's largest rocket, standing tall in a 30-story building and measuring 35 feet in diameter. A National Aeronautics and Space Administration program, Saturn V will be used to launch men and equipment into earth orbit, lunar orbit, moon landings and deep

space. Saturn will be able to place 180 tons in earth orbit, or transport several tons of instruments to Mars. Boeing holds NASA contract to develop, build and test the S-IC stage. Lockheed, managing the F-1 engines, developing a total thrust of 7.5-million pounds, equal to about 160-those Superjets.

Capability has many faces at Boeing



TWIN TURBINE Quietest-known Boeing Ford naval transport helicopter, now in operation with U.S. Army. Character: seven 25-hp, compact engines, cruise at 150 mph.

LUNAR LABORATORY and living quarters for lunar research are in space, based on Boeing study. Also, under NASA study systems and on new research program, Boeing is studying manned orbiting research station, heavy vehicles, lunar exploration and deep space probes.



AMERICA'S NEWEST jet, the short-range Boeing 737, enters service early next year. The 737 will be able to serve cities now bypassed by big jets. Airlines have already ordered 347 Boeing 737s.

BOEING

Boeing Aircraft Company, Boeing Building, Boeing Way, Seattle, Wash. 98104. Boeing Aircraft Company, Boeing Building, Boeing Way, Seattle, Wash. 98104.

WHO'S WHERE

In the Front Office

Clarence J. Woodard, president The Boeing Co., O'Fallon, Calif., according to Clark F. Butler, new board chairman and chief executive officer. W. Gordon Jarvis succeeds Mr. Woodard as vice president, fiscal manager.

Wilton Farber, a vice president of Rocket Power Inc., Men, Ariz., a subsidiary of McDonnell Corp., has been named president of McDonnell's newly established Pacific (Calif.) Branch Div.

Edward W. Vignio, a vice president of Bell Aerospace Co., is change of all Washington (D.C.) operations.

E. Douglas Kozicki, a vice president of Avco Corp., the general manager of the company's Research and Advanced Development Div., Washington, Mass.

Douglas F. Johnson, elected a director of Avco Corp. (AW No. 18 p. 21).

Donald M. Wilson, vice president for Navy programs, Lockheed-California Co., Burbank, Calif.

Leslie R. Goble, a vice president, Northrup Div. of Northrup Corp., and manager of the Precision Products Dept., Northrup Corp., according to William A. Jones, manager.

Charles A. Dettmer, vice president emeritus, Boeing Western Hydrolics, Ltd., Van Nuys, Calif., a subsidiary of Raytheon Corp., and Thomas F. Fitzgibbon, vice president sales and marketing, Kollsman H. Knox, vice president engineering at Westinghouse also named a director.

Thomas J. Boring, corporate controller, Trans World Airlines Inc., according to James P. O'Connor, Jr., president.

Dr. D. W. Randolph Llewellyn, Jr., president of the Lockheed Foundation for Studies in Education and Research, has been appointed a consultant to Dr. George F. Buehler, associate administrator for manned space flight, NASA.

Honors and Elections

Charles F. Rose, president of General Dynamics/Toronto, has been elected by the Electronic Industries Assn. to receive the EIA Medal of Honor for "outstanding contribution to the electronic industry."

A Paul Verna, Jr. Los Angeles, has been elected president of the National Photo Assn. Inc. (NPA). Also Dr. Mark DeGaulle, Tulsa, Okla., is vice president and Mary Jo Lark, New York, 2nd vice president.

I. F. Dymally, chief executive, Trans-Canada Air Lines, has been elected president of the Society of Automotive Engineers for 1964.

Dr. Arnold G. Beckman, president of Beckman Instruments Inc., has been elected chairman of the board of members of the California Association of Scientists according to the late Robert L. Mendel.

Changes

Robert E. Rutherford, Jr., chief engineer, CBS Laboratories, Elstree, York, Dept. Headed, Coles, and Neil Decker, action head, CBS Laboratories Military and Industrial Systems Dept.

INDUSTRY OBSERVER

■ Pentagon proposes to continue funding of Nike X anti-ICBM missile development in Fiscal 1965. Present stage of development involves the need for a decision on whether to convert the missile to production unit at least Fiscal 1966.

■ National Aeronautics and Space Administration's Marshall Space Flight Center is considering payload and inspection analyses for a vehicle configuration incorporating a liquid hydrogen-oxygen Douglas S-4B stage ship a half length, 20-in. dia., solid-propellant motor, now in feasibility demonstration phase for USAF's Space Systems Div.

■ Interest in cruise missile development has spurred design work within the Argentine government's aeronautics DINFA (Direccion Nacional de Fabricaciones e Investigaciones Aeronauticas) in Cordoba. Two single-engine COIN and design for launch purposes for integration development of DINFA. One design, the I-A 55, would be powered by a Turboveron Avation 10 engine, giving it a cruise speed of about 700 mph with a 1,170-hp cruise engine and 150 gal. of kerosene.

■ New propulsion contractor for Advanced Research Projects Agency's high-speed bomber experiment (HBBEX) now be selected by Boeing, the present contractor, for development of the vehicle's high-acceleration and cruise. Cost negotiations between Boeing and Hercules Powder Co., previously selected as propulsion contractor, have not been resolved.

■ Third General Dynamics-Aerodynamics Contract, upper stage is expected to be launched from Cape Canaveral between late March and mid-April. The hydrogen-fueled stage will be delivered to NASA next February.

■ Modified version of the Sparrow air-to-air missile recently demonstrated its capability as an air-to-air-to-air-to-air weapon during tests conducted by Navy and Raytheon. The missile proved to accurately on a goal of radar set up as a target that it went through the area in which the antenna was mounted. Raytheon also has developed a post-mounted guidance system which enables the Sparrow to be aimed against moving ground targets. In air launch tests, missiles scored hits against two small bugs.

■ NASA's Flight Research Center at Edwards AFB will issue requests for proposals in January for a powered version of the M-21 aircraft lifting in cruise vehicle in a strategic mission. Flight up to about March 15. The plane will call for dropping the vehicle from a Boeing B-57 at about 40,000 ft. The M-21 will then climb to about 75,000 ft. before reentry. Lockheed may propose an F-104A biplane in the powered case test for the M-21 cruise vehicle.

■ McDonnell Aircraft Corp. may seek another customer source for alternative thrusters in the 25- and 100-lb-thrust categories for the Gemini spacecraft attitude control system. Problems have been experienced with thrusters of these types built by Rocketdyne, developer of the control system for McDonnell (AW July 22, p. 284).

■ Proposals relating to a submarine-launched ballistic missile considerably larger than Polaris were submitted recently to Navy SeaWeys Special Projects Office as part of a study of advanced air-based deterrent studies. Contract award may be made next month. Proposals previously submitted (AW No. 4, p. 21) were for a configuration smaller than Polaris. Both missiles will be designed to be launched from great depths.

■ Naval Ordnance Test Station (NOTS) will have extensive management responsibility for the Gemini air-to-ground missile. Industry will support NOTS in development of certain submodules (AW Dec. 9, p. 21). For development phase of the program is expected to be initiated early next year.

■ Close of a contractor for the Minuteman ICBM launch vehicle system (AW Nov. 4, p. 21) a seven-bidder contest to create full-scale launch, is expected to be announced early in January. Two finalists in the Ballistic Systems Div. competition apparently are Hughes and ITT.



Tactical rocket probes for over-the-horizon intelligence will fill a vital need for our Armed Forces.



Getting the job done takes this kind of electronics systems background.

Bendix background in electronics and systems management includes being system manager for AN/AMQ-15 weather reconnaissance program, system integration manager for the Navy's satellite communication's ship-board terminal on the USNS Kingsport, system manager for an Air Force rocket communications system and system manager for the Talos missile. This collective experience is currently being applied to active rocket probe programs for over-the-horizon intelligence at the Bendix Systems Division, Ann Arbor, Michigan.

Bendix Systems Division



WHERE IDEAS
UNLOCK
THE FUTURE

Washington Roundup

Disarmament Probing

Metrial reductions in defense spending will be one of the first discussed when U.S. and Russian Disarmament negotiators sit down at the conference table in Geneva Jan. 21 for another meeting of the Eighteen Nations Disarmament Conference.

But high State Dept. officials see little chance of accomplishing anything beyond talk because of the Soviet's reluctance to accede to U.S. inspection demands. At one high official put it succinctly: "We have no way and might not of knowing what their budget is and what it means in military terms without an enormous amount of espionage."

Even though all sides want to put "some cooling on this area now," the official said, progress will be made through reduction of tensions rather than through completed agreements. It has been the Russians who in the past have suggested bilateral cuts in military budgets, according to the State Dept.

The most serious trouble stands in front of a proposal for a U.S.-Russian ban on USAP (B-47) and Tu-16 Bombs. London has passed some of these aircraft from going to nuclear nations. Already, Australia is receiving B-47s, and Egypt and Indonesia have Tu-16s. Anything less than a well inspected destruction of these bombs can be avoided by U.S. inactivation in October 1968.

Another disarmament topic at the coming meeting is ways to detect new buildings by satellite inspection. Such is such critical updates in intelligence. U.S. has explored with such techniques under Project Cloud Gap, a joint Defense Dept. and disarmament agency effort.

Most significant than the results of these specific disarmament will be the general climate prevailing at Geneva. Forerunners see favorable signs in U.S. and Russian reductions in military spending, the Yalta lowering of the Berlin wall and the good-will usually extended a new President.

Presidential Action

President Johnson's appointment of a Committee on the Economic Impact of Defense and Disarmament underscores the Administration's concern about the immediate effects of base closings and other economic actions as well as the long-range problems posed by disarmament.

The new committee's job is to review and coordinate Executive Dept. attempts to determine the consequences of changes in military spending. With this knowledge in hand, President Johnson said, the government will be in a better position "to measure potential disturbances which may arise from changes in the level and pattern of defense outlays."

Heads of several executive departments were requested in the President's memorandum to meet weekly efforts to serve on the committee. The Council of Economic Advisors representative will serve as chairman. Other departments and agencies to be represented are Defense, National Aeronautics and Space Administration, Commerce, Labor, Transportation Agency, Atomic Energy Commission, Office of Economic Planning and Budget Bureau.

Chairman Walter W. Heller of the Council of Economic Advisors formed such an "early morning" group July 28 (AW Sept. 30, p. 21). Defense Dept. already has asked the Institute for Defense Analysis to find a way to guide the various defense planning to companies and communities; heard with responding to changes in defense spending. President Johnson and he wanted to give Heller's group "a more formal and permanent status."

Congress also is trying to affect the impact of changes in federal spending and may be able to agree on a legislative approach to the problem next year.

Information Scrutiny

Many informants next year plan to use less confidential sources as government information policies regarding: (1) how information was handled during the Cuban crisis and the Defense Agency which has gone into the information cuts the "World War II" information plan; (2) NASA and Defense Dept. agents on their own and foreign satellites—including heavy criticism of the U.S. policy of not disclosing anything about Russian launches until the Soviets do; (3) use of detectors by government agencies; (4) expression by government agencies—including NASA and Defense Dept.—of their information policies.

Initial Reaction

Air Force press officers are angry about NASA taking the executive order out step further by adding it own addition to the new name for the Cape Canaveral launch complex, designating it as the John F. Kennedy Space Center, NASA.

FAA is considering installation of a low-cost instrument landing system for the air strip at President Johnson's Texas ranch.

Chairman John L. McClellan of the Senate TFX investigating subcommittee still intends to call former Navy Secretary Fred Korth, along with Defense Secretary Robert S. McNamara, at a station where hearings means next year.

Congressmen press Robert Smith Institute for Naval Research has developed variable sweep wing designed for speeds of Mach 5.

—Washington Staff

Nuclear Flight Programs Canceled As President Trims FY'65 Budget

Washington—President Johnson's economy as last week left on the Navy's nuclear propulsion flight program, and they budget requests and the Navy's policies of the U.S. government.

Atomic Energy Commission and Naval Administration and Space Administration as a joint announcement Dec. 14 and the Lockheed RFL (nuclear-flight test) project is canceled; the Navy's nuclear engine for model vehicle applications development effort will be stretched out.

The post AEC-NASA Space Nuclear Propulsion Office estimates 1,500 costs will be affected by the cancellations and stretch-out—\$75 at AEC, \$90 at Lockheed and \$20 at Westinghouse. AEC is expected to save \$35 million in fiscal 1964 and \$54 million in fiscal 1965 while NASA is expected to save \$15 million in fiscal 1964 and \$35 million in fiscal 1965.

These economy efforts, the agency said, "will save as much as \$150 million of planned and programmed funds in fiscal 1964 and 1965." AEC and NASA said that they have invested \$450 million on Rover. President Kennedy, after meeting Rover staff members in December, 1963, resisted proposals to cut the program and approved them then requested (Dec. 17, 1963, p. 23) President Johnson's action shows he too agrees with these views who contend it is too early in the history of the nuclear

technology to invest heavily in actual space flight vehicles. He is expected to develop proposals for the Rover as fiscal 1965, at about \$100 million less than the agency requested.

Los Alamos Scientific Laboratory will continue Kroc nuclear reactor ground tests through the next 12 months and make a try to develop higher powered prototype reactors under the project code of Phoenix.

The stretch-out of the 1,800 engine development project, being conducted by Aerojet and Westinghouse, will be accomplished by postponing flight system development. Instead, the contractors will concentrate on nuclear engineering and the development of developing an operating experimental nuclear propulsion engine. AEC and NASA said they contemplate building a first version eventually, but did not specify a schedule.

NASA's Marshall Space Flight Center directed Lockheed's RFL project. The agency demands "almost all" of the \$14 million already invested in RFL in applicable to other programs. No flight hardware has been built. The RFL program called for delivery of the actual flight stages and testing them in 1966

Minimum Decision

President Johnson is to meet with the joint chief of staff and the Joint Chiefs of Staff on Dec. 10 and then to decide whether to postpone \$60 or \$100 USAF Budget Minimums under the fiscal 1965.

As for the Chief of Staff Gen. L. B. LeMay is quoted as saying that the Navy and Defense Secretary Robert S. McNamara have the nuclear program. The President's decision will determine whether the U.S. will have the L200 in 1965 Minimums. Another case to be discussed is whether to hold a pre-emptive strike for the continental air defense force.

and 1967. Last year the flight date slipped to 1970 because of engineering problems with the Kroc reactor.

President Johnson discussed other economy moves between meetings with high government officials at his Texas ranch over the Christmas holidays. He said \$9 billion in military budget requests was denied. This, however, is specific to the defense. Secretary Robert S. McNamara said he decided \$1 billion in fiscal 1964 budget requests from space (AW Dec. 21, p. 26). The other economy move was setting off the stage on the level of employment for all agencies. He said that the RFL and there will be fewer federal employees in 1964 than there were in 1963.

Boeing to Build Lunar Orbiter

Washington—Boeing Co. last week was selected for a \$40 million contract from the National Aeronautics and Space Administration to build the Lunar Orbiter spacecraft.

Boeing's proposal was selected after NASA's top management re-evaluated bids submitted by five firms. The others were Hughes Aircraft Co., Lockheed Missile and Space Div., the Martin Co. and RWAY Space Technology Laboratories.

NASA said Boeing's proposal was selected because it offered the greatest assurance of mission success. The Boeing proposal included use of a three-year development system similar to the one on the successful Mars 3 Venus spacecraft, the Eastman Kodak-developed camera system and Radio Corp. of America power and communications systems.

Assistant Witek & Space Technology Inc., which has bid \$40 million as the biggest, but that the firm won the contract because of the high reliability factors in the spacecraft design approach.

Of all NASA's managers, the lunar flight program has the least success rate. All three Atlas-Able flights in

1958 and 1960 failed and all five Ranger flights—three of them have photographic cameras—were unsuccessful.

NASA canceled five Ranger flights—Ranger 10 through 14—on Dec. 11, (AW Dec. 21, p. 26), cutting the program back to four remaining flights—Ranger 15, the next scheduled, is to be launched in February.

With the first manned landing still scheduled in late 1968, time is fast running out for the reconnaissance of lunar landing sites by unmanned probes.

Although the remaining Ranger flights and the first of the Surveyor will have landings are scheduled to take place before the first lunar Orbiter is flown in 1966, the Lunar Orbiter is viewed as a determined attempt to ensure availability of lunar surface pictures if all else fails.

NASA and the military contract with Boeing (AW Oct. 7, p. 32) would provide for a spacecraft of 100 lb or under to fly on the Atlas Agena rocket. The spacecraft is to carry scientific instruments, as well as cameras, to investigate lunar conditions and successful orbital

Flights Replace Hours as Measuring Unit

By Larry Bonds

Washington—Number of flights, rather than hours flown, will soon become the standard of measurement for accident analysis and cost effectiveness studies in the Air Force, Navy and Army.

For nearly a year, individual services have been trying to find more reliable ways of measuring aircraft operations so that budget requests can be justified with factual statistics.

Both Navy and Army have the change and have reluctantly accepted it to the accuracy of flights. The Air Force was slow to accept the idea but recently changed its position and now looks favorably on it.

Key factors behind the proposal is flight length. One flight usually is 10 to 15 minutes, regardless of its length. Thus, a number of emergency missions must be based by service on personnel and operations planners. Among them are:

• **Exposure to hazards.** The critical portion of a flight is taken over full land conditions, early climb, wave count and other operations and the fuel approach and landing. An average flight includes at least one of these, or a number of its elements.

• **Maintenance.** Periodic maintenance and overhaul in the past has been based on hours flown. But maintenance is performed between flights, to check aircraft parts and replace them if needed. Most parts never are replaced even on take off, climb and landing.

• **Cost effectiveness.** Importance of the mission must be weighed against the fraction of engine, aircraft, crew, cost of maintenance and cost of operations. Again the flight rather than the hour standard fits more easily into this type of cost-effectiveness analysis.

• **Cost effectiveness.** This has been a study of interest in the military. A jet fighter or attack aircraft pilot who

has been flying five years may mean 1,160 pilot flights, a bomber pilot 3,200 or, and a transport pilot 4,500 or. The question must now arise, "Does the pilot with the most hours have the most experience and greatest competence?"

Experience has shown that when analysts compare costs, they find themselves comparing on the basis of flights rather than hours. In a single flight, the landing gear will be cycled once, the aircraft and again before landing. Improvements and changes in the subsystem data is needed on the basis of the number of times used, not how long it was down. Engines are operated at these maximum points for take off and climb, power for the climb. Carrier aircraft use high power for most portions of their combat missions. For straight and level flight there is little strain placed on the engine.

The one-way flight principle applies to other subsystems as well. Bombs are dropped only once by the large bombers. They are dropped several times by attack aircraft but each individual bomb is used only once. The one-way flight principle also applies to the number of flights rather than the hours flown. An aircraft is an exception. Electronic equipment lives are based on time. But even here the effects of landing and carrier maintenance are considered on a single flight because aircraft are not in service.

Accident rates have been tied to hours flown since the early days of aviation. However, most accidents occur on takeoff and landing. Thus the long duration portion of aircraft have much lower accident rates per 100,000 lb flown. In order to compare accident rates by budget purposes, the use of the flight standard will be more realistic than it will equalize accident rates between small jet aircraft, large bombers and transports.

Pilot qualifications have also been tied to hours. Pilots in non-flying billets who are not the planned and age requirements for future combat duty must fly 100 lb per year. One jet pilot explains

it this way, "In order to get my 100 lb I have to fly the T-33 jet trainer. My average time per flight is 1½ hours. That means I have to make 132 flights a year. I'll be flying 132 flights a year by up to 12 lb or more per flight."

In making cost effectiveness of aircraft, three principal factors are used. One is the same, a flight in which a military mission is performed. The second is cost. Third is effectiveness.

Effectiveness is generally stated in terms of percentage of targets hit, whether it be percentage of destruction of a bombing target, target put out of action, or percentage of aircraft destroyed in a strike mission or ship sunk. During World War II, the popular system for measuring bomber effectiveness was loss of high explosive bombs dropped on a target. This system was applied to nuclear weapons when they came into the inventory by stating strength in kilotons and megatons. Now it is gradually being phased out in military planning.

One result of applying cost-effectiveness principles to tactical aircraft missions as compared to conventional bombs, with yields in pounds or tons, is the discovery that a simple, less complicated aircraft mission is much better than a complex mission. As one officer puts it, "Don't buy a megaton airplane to carry megaton bombs."

Master Delays

Washington—Continuing delays and problems in the development of the Navy's nuclear propulsion system have caused some to doubt whether the program will be completed in time to meet the Navy's needs. The program is reported to be about 18 months behind the original schedule, which called for completion in fiscal 1964.

During completion of the study, Army has not had monthly funding about 60% from the previous \$65 million. Navy contractors like the Martin Co. and Westinghouse are complaining the budgeting delays and the Navy's delay in approving the program.

NASA's difficulties reportedly are the result of the operational approach that the missile be able to be targeted over a wide range of distances, to target as close as 500 yards. The trouble is heavily attributed to "producer difficulties." But the approach, which is to use a missile to deliver nuclear warheads and could include some non-nuclear warheads at short ranges.

Observers close to the program expect that it may be cancelled unless successful flight demonstrations are made in this spring.

Apollo Guidance Probe

Washington—Reports critical of the Apollo guidance development program have been turned over to staff members of the House space committee for further investigation.

Antonia Witek & Space Technology disclosed that members of the committee have planned a brief investigation before the Committee on Aeronautics and Space (AW Dec. 21, p. 27). Following two meetings last week, Rep. Glen E. Tamm (D-Tex.) and the report could enough detail on the availability of the system being developed under the direction of the Astronautics and Space Administration Laboratory at the State of Technology to warrant further investigation.

NASA mentioned that addition of backup guidance computers, which would be automatically taken on when one of the computer system, answers most of the answers in the military reports made study by the House space committee.

Receiving Kits May Widen Tiro's Data Use

By George Alexander

Capo Cassano—Systems of the first Automatic Picture Transmission (APT) camera system aboard the orbiting Tiro 8 meteorological satellite has suggested plans for simple, low-cost ground receiving kits with which any local commercial television station could serve its community with real-time weather displays and analysis for that particular area.

Rufo Goy, of America, developer of the APT system and holder of the Tiro satellite under contract to NASA's Goddard Space Flight Center, is understood to be on the verge of negotiating an APT ground kit for single weather stations which would cost around \$25,000. Most of the ground stations purchased by users for the APT program from the Fairchild-Stratus Corp. cost approximately \$32,000 each.

Beyond this, RCA is said to be actively considering kits consisting of a viewing antenna, photoreceiver, microscope and related equipment, which would sell for an as yet undetermined price but which would be within reach of most commercial television stations. If the market should develop as expected, Fairchild-Stratus and other firms undoubtedly would join RCA competition in a situation like this, the firm believes that a cost of less than \$100 but for a complete kit that includes the antenna and the receiver.

Fairchild-Stratus has definite plans to continue development and marketing of Tiro ground stations of which it has now delivered 47. Production is at semi rate (number 51), and a station has been ordered by the French government. The third unit.

Two 5 and the APT system were launched from here at 4:10 a.m., EST, Dec. 21 after a week of preparations directed by the Delta launch vehicle (AW Dec. 21, p. 25). The 350-lb satellite was injected into an orbit whose apogee was 450 mi., perigee of 378 mi., period of 98 min., and an angle of inclination of 10.5 degrees. The 19.5 day-alt satellite will perform planned operations. The satellite entered a conical orbital 105-day, low television camera, two of which have been flown on all previous Tiro spacecraft, but not in fixed sensors. The agile TV camera was not viewing targets after orbital insertion and both NASA and RCA officials were attempting to determine a cause by late last week. Substitution from a strong ground radio station was considered as a possible cause.

Demonstration of the APT system's capability, and of ground stations' ability to receive and use the data transmitted by this system was of prime importance in this flight. The APT flew about Tiro 8 at the same type of camera that has been shown the more advanced Minuteman weather station, the first of which were slated for launch in the first quarter of 1964 from Pacific Missile Range. APT was conceived as a simple and

in a lifetime of the camera even as much as a one-year orbital period.

The programmer also permits NASA to command the APT system to begin operating when passing over an area—such as in the South Pacific—where observation and lighting requirements are satisfactory, but where there is no station capable of sending a "home" signal to the satellite. Without this provision, the APT system would come on whenever the sun was in the proper position, regardless of the earth's location. The system therefore could hardly photograph other space.

In fact, last week, there were stations in France, the Indian Ocean, England, Australia and Canada equipped with APT receiving kits, in addition to 60 U.S. stations on the continental U.S., Hawaii, Alaska and Puerto Rico, and U.S. military installations in New Zealand, Okinawa, the Philippines, Spain, Germany, Japan and Turkey. Only four U.S. stations—Alaska, Wadsworth, Alaska, Ft. Meigs, Calif., and Francisco, N.J.—have the ability to control the camera to target specific locations. Remote operations are controlled by a timer aboard Tiro 8 and this can be set to begin up to 3 h after receipt of the "go" signal.

The APT camera consists of a special RCA-developed lens, a large lens, a photoreceiver antenna. Ground control is by the camera, a clock on the surface, represented by a polyethylene layer for calibration image motion, and a clock on the surface.

An electron beam scanner then scans the image as a series of varying voltages and transmits the data to ground stations via a 1-megawatt ground station. The current that the line current on conventional radio-photograph transmits nuclear. Total time for transmission of a single picture is 20 sec., with 8 sec. selected for preparation of the image, 12 sec. for exposure and 200 sec. for the ground station to receive the image in three frames during the overhead pass of Tiro 8.

A second APT camera is expected to be flown aboard Tiro 12 (AW Jan. 24, p. 10). This will be a "wheel" version of the first-generation meteorological satellite and will be spin-unloaded on its launch vehicle. It will be launched through space like a spinning wheel and the APT camera will be pointed toward the earth over every revolution. Life time of this camera is expected to be about 1,000 h.

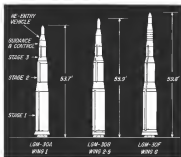
The second launch of Tiro 5 was the 21st consecutive series by the Douglas Aircraft Co. built through Delta launch vehicle.

Aeronautics Joint Venture

Martin Marietta and Thompson Brown Woodbridge have agreed to form a jointly held company, under the name of the Tiro Corporation. The company, which is a subsidiary of the Delta launch vehicle, will be responsible for the design and construction of the Delta launch vehicle and the Tiro spacecraft. The company will also be responsible for the design and construction of the Delta launch vehicle and the Tiro spacecraft.

Martin has long been interested in expanding its interest in the Delta launch vehicle, particularly computer capability. In the past several years, it has attempted to purchase into General Dynamics and Space Systems Corp., both of which have been computer divisions.

Tiro Corporation is a joint venture of the Delta launch vehicle and the Tiro spacecraft. The company will be responsible for the design and construction of the Delta launch vehicle and the Tiro spacecraft. The company will also be responsible for the design and construction of the Delta launch vehicle and the Tiro spacecraft.



Minuteman Range, Payload Boosted

Minuteman ICBM, now undergoing its third major change will have greater payload capabilities than ever before. Minuteman I, a Weapon System ICBM, which is scheduled for installation in Wing 1 through 5, consists of two modes. Wing 1 deployed area Minuteman ICBM—Must—(the closest of all Minuteman wings to potential targets) has the LGM-30A, whose range is below the design depth of 6,000 mi. Wing 2 has the LGM-30B model which has the improved intermediate second stage (AW May 11, p. 14) and large motor vehicle and is capable of traveling more than 6,000 mi. Wing 3, now under activation, now General Dynamics, will carry the LGM-30F, the first model in the new Minuteman 2, to various areas. LGM-30F will carry a large second-stage motor with a multipurpose system capable of replacing the four available third-stage motor control modes and permits (AW Nov. 10, p. 10; Dec. 2, p. 41) and a new motor vehicle. As Force is being added into C, D and E in more, possibly the deployment of these smaller models of the A and B configurations. In the official LGM-30B deployment, it is expected to be completed by 65 days for the second stage, 31 miles, payload, and 30 is the Minuteman design. The first representative missile from Cape Canaveral has designation LGM-30B.

NASA to Re-acquire Large Solids Program

National Aeronautics and Space Administration is about to reacquire the large solid motor program which it added to Defense Dept. in 1962—when responsibility for the Defense Dept. was transferred from DOD to the civilian space agency.

NASA is authorized in using a half-billion 200-mi. motor adds a Saturn 5-50 second stage (AW Dec. 23, p. 40) to boost payloads of 50,000 to 60,000 lb into low earth orbit. Industry specification is that the agency would use such a vehicle to fly small test structures as payloads at large altitudes.

The number of the program is expected shortly when an agreement between the Defense Dept. and NASA is reached.

News Digest

Federal Aeronautics Agency last week set May 15 as the deadline for design proposals for a short-haul, passenger-carrying transport (AW Nov. 4, p. 26). Proposals will be used as a basis for selecting up to three contractors to prepare design specifications for an aircraft suitable for short-haul routes. Contracts will be limited to \$108,000.

C. E. Woodson, 71, president and general manager of Delta Air Lines, announced he will relinquish the top post as Jan. 15, 1965, to Ted Johnson, 44, who recently joined the airline as executive vice president.

IBM Federal Systems Div. will build a new, air-tight, low-cost, low-maintenance system, to investigate the feasibility of satellite communication, under a \$55,515 contract. NASA's Manned Spacecraft Center. The system, which will use a radio-astrometric injection laser, actually will be evaluated in point-to-point ground tests followed by aircraft ground tests. System delivery date is late 1964.

Malaguer and the U.S. Air Force reached agreement last week on installation and operation of a transportable tracking station at Malaga, on the island's northwest coast. The station, which will be operated by NASA and Malaguer personnel, will determine whether satellites launched from the Pacific Missile Range have been injected into orbit.

Electronic Industries Assn. will shadow its quarterly survey of semiconductor sales. The action stems from the decision of a major component supplier to stop its participation in the voluntary industry survey to EIA by June. The survey data is linked to the press (AW Dec. 21, p. 45).

Minuteman, last week was awarded a contract to build at least three and possibly 12 second-stage rockets for the Defense Dept. and the Air Force. The contract, which could total as much as \$50 million, is a follow-on to the one NASA awarded to the firm in March, 1962.

Korean Aircraft Corp. has reported a set for 1965 estimated at \$1,400,000 and has counted the stock available in previous years. Charles E. Korman and the loan was due to write off against product improvements, research and development program costs should with the government, improvement in the program being delivered to the customer and changes in procurement policies.

1963 Trunk Profit May Pass \$100 Million

Traffic growth of 14% seen; financial outlook is bright for domestic and international airlines in 1964

By L. L. Doty

Wadlington-Optima, over prospects for growing earnings in 1964 is prevailing throughout the U. S. airlines industry as early estimates indicate a 14% increase in traffic for 1963 compared with 1962, and a strong possibility that 1963's net profit will pass the \$800 million mark.

That American Wreck & Space Technology traffic forecast, slightly higher than the 11.9% gain predicted in December by the Air Transport Assn., is based on actual operations for 13 months and an estimate for December. The net earnings forecast were projected from the \$72.3 million actually reported by the industry for the first nine months of 1963.

Similar optimism for a 1964 improvement is being expressed in the international field. Sir William Hildred, director general of the International Air Transport Assn., last week predicted that the world's scheduled airlines will show a 14% increase in both the number of passengers carried and revenue passenger miles from 1962 to 1964.

Expectations that 1964 will bring about a continued expansion of business is based principally on the present healthy state of the general economy and the steady expansion of airline traffic during the past several years. In 1961, the U. S. airlines reported a 1% gain and, in 1962, a 7.8% improvement in revenue passenger miles.

International scheduled airlines of the world showed an air traffic increase in 1961, a 4% gain in 1962 and International Civil Aviation Organization has estimated a 6% increase for 1963.

W. A. Patterson, United Air Lines chairman, in his year-end report, said that "1964 could be the most rewarding year since the jet age began." He noted that "airline traffic will reflect the strong upward trend economy predict for business in 1964," and added:

"Revenue passenger miles flown by the nation's trunk airlines probably will increase about 7% over the 1962 total. Earnings should improve as a result of 1963's growth and further absorption of costs associated with the normal change from paper to jet air craft."

George P. Hurd, vice president economic research and financial relations for American Airlines, who predicted "better-than-average" gains in 1964 if the general economy performs as expected.

Hurdberg agreed that the industry's net profit will show an improvement in 1964.

1963, but noted that earnings will be only 2 cents on each mile flown, barely one-third of the amount required to cover the other on total revenues considered reasonable by the Civil Aeronautics Board.

Hurdberg also showed concern that the industry may not be as successful in managing the annual cost increase in 1964 as it was in 1963. Hurdberg estimated that 1963's net increase was 5% for the 11 airlines. He said:

"It will be difficult to hold expense to as small a rate. Expenditures in employee

pay and prices of materials and outside services usually add this much or more to expense."

Hurdberg estimated traffic increases for 1963 at 13.5% and revenues at 5%. For the first nine months of the year, total operating revenues had climbed 3.1% over the same period in 1962, and total operating expenses rose 6.1%. Operating profit for the first three quarters of 1963 was \$216.9 million.

Individually, airlines will report substantial gains in traffic during 1963. Eastern Air Lines will show an unusually high increase this year over last, but this is mainly due to the 1962 strike that grounded Eastern between June 13 and Sept. 13. Northeast Airlines' annual traffic was retarded last year because the loss of some of its fleet curtailed operations (AW July 1, p. 37), and the CAB order removing the carrier from the New York/Florida market diverted passengers to competitors (AW Aug. 26, p. 35).

Continental Airlines is expected to show the highest percentage increase in traffic for 1963. According to Robert F. By, the airline's president, Continental will have flown more than 1.7 million passengers during 1963, a gain

Transatlantic Commodity Rates Lowered

International Civil Aviation Organization has approved a 13.26% reduction in specific commodity cargo rates on transatlantic routes.

The rates effective for a two-year period beginning next April 1, apply to commodities that comprise the major volume of cargo traffic on the route and include a variety of especially low rates designed to increase traffic in commodities that currently move by sea only in limited quantities.

These are examples of new rates, based on the New York/London route:

- Machinery and tools. Previous general average at present cargo rate, there may now be transported as specific commodities ranging from 40 cents per lb. on shipments weighing 110 lb. to 21 cents for shipments of 2,200 lb. or more.
- Automobiles and agricultural parts. Rates are 54 cents per lb. for 100 lb. and 21 cents per lb. for 440 lb.
- Office machines and parts. There will be charged for 13 cents per lb. for 220 lb. and 21 cents per lb. for 440 lb.
- Radios, telephones, electrical appliances and parts. There have a new rate of 43 cents per lb. for shipments of 300 lb. decreasing to 21 cents per lb. for 2,200 lb.
- Manufactured textile products. Rates are 34 cents per lb. for 99 lb. and 28 cents per lb. for shipments of 1,100 lb. or more.
- Chemicals. The rates are 42 cents per lb. for 500 lb., 40 cents for 220 lb. and 24 cents for 1,100 lb.

General cargo rates remain at the present levels and weights, decreasing from 54 lb. per lb. for shipments under 99 lb. to 35 cents per lb. for shipments in excess of 1,100 lb.

IATA also established minimum rates for certain classes for cargo weight of 110 cents to 18 cents per available ton mile, depending upon the type and capacity of the aircraft.

The new rates were worked out during a special IATA traffic conference earlier this month in Miami.



Successful First C-141 Flight Begins Extensive Test Series

USAF Lockheed C-141 StarLifter, which flew for 51 min. on Dec. 13 during its first flight test, will now undergo an extensive series of flight tests scheduled to run through next year. The Dec. 17 flight was made at a gross takeoff weight of 314,000 lb. The aircraft was loaded at 120 lb. and maximum speed during the flight was 340 kt., with load limit gear remaining fully extended throughout the flight (AW Dec. 23, p. 42).



AIRLINE OBSERVER

►Titled of 10 U.S. airlines have sent the Federal Aviation Agency of their intent to initiate manufacturers' proposals for the design of the supersonic transport. Drafting for submission of these proposals to FAA by manufacturers in Jan. 15. Government and airline evaluations will be formally reviewed in discussions scheduled for Mar. 23 and 26. Airlines participating in the initiative are: American Airlines, Braniff Airways, Continental Airlines, Delta Air Lines, Eastern Air Lines, National Airlines, Northwest Airlines, Pan American World Airways, Trans World Airlines and United Air Lines.

►Watch for a move by India next year to expand Air India routes in Africa.

►FAA has proposed a rule requiring the installation of cockpit voice recorders on all turbine-powered aircraft by July 1, 1968. Rule also will call for installation of the equipment which will record flight crew conversations, on all pressurized four-engine piston aircraft by Jan. 1, 1966, and on all other aircraft in commercial service by July 1, 1966.

►Airlines will install static discharge wicks on all aircraft in response to an FAA recommendation that the device be installed on all jet aircraft (AW Dec. 25, p. 41), despite wide disagreement over their effectiveness. Of the total of 481 jets operated by U.S. airlines, 117 will be retrofitted with the wicks. The rest are already equipped with them. The 117 aircraft include 41 Boeing 707s, 41 Douglas DC-8s and 26 Canadair 990 and 600 models.

►Hansa's Aeroflot is continuing to place twin-jet Tu-124s on more routes despite the road water reduction in one-off service. New Tu-124 routes include Volgograd-Kiev, Ruman-Gdansk and Gorka-Moscow. Vladivostok, a Caspian route. First scheduled international service with Tu-124s—Moscow to Helsing, Vienna and Copenhagen—begins in November. Aeroflot has also inaugurated Moscow-Chelyabinsk flights with transport 800-passenger Tu-144s.

►Washington National Airport's north-south instrument runway will be closed for four months beginning April 27 to permit resurfacing and installation of trackdown zone and center-line lighting systems. Installation of temporary navigational equipment to permit instrument use of the other two runways is now under consideration by FAA. Operating minimums of the airport are expected to be raised substantially during the construction period.

►Civil Aeronautics Board has released a tentative proposal for a local service class include rate formula. Proposal represents a shift position on subsidy and has not been passed by the Board. Proposal estimates a total annual subsidy of \$66 million compared with the rate established July 1, which was estimated to provide annual gross subsidy of \$67.3 million. Board will hold informal discussions with the carriers on the plan, but no agreements reached are not binding on the Board. Proposal is published as a 16% rate of return on equity, 7.5% return on preferred stock and 5.5% on debt.

►Lease agreement between Pan American World Airways and South Pacific Air Lines, which permits Pan American to operate the Honolulu-Tahiti route for an interim period, has been approved by CAB. Expedited leasing on the joint application for the sale of South Pacific's operating rights on the route to Pan American has been scheduled.

►British Ministry of Aviation is studying the effect of gun dust, purple or violet to repel birds from airports and runways. Studies indicate that the coloring has some effect on magpies and other birds, but coating and painting have yet to be worked out. In the latest bird repellent experiment being conducted at Prestwick, Scotland, the Ministry has been using carbide gas, in which a chemical reaction produces a series of loud impacts to drive birds off the runway and approach path.

SHORTLINES

►American Airlines flew 151 million ton miles of freight during the first 11 months of 1965, a 6% increase over the volume handled in the same period last year.

►Bosnian Air Lines has posted the 50,000 passenger mark in one year for the first time. Total number of passengers carried since Jan. 1 exceeded that figure in early December and the company expects to go over 137,000 by the end of the year, which would represent a 26% increase over the 1960 volume. Bosnia is projecting an income to more than \$100,000 bookings in 1964.

►Carson of high-quality, ultrathin glass was flown by Pan American World Airways around the world from Vienna, Austria, to determine whether air freight handling for fragile products was possible. Glasses completed the 21,160 mi. trip in two days in perfect condition.

►Civil Aeronautics Board has approved a group fare-basing rate proposed by Trans-Caribbean Airways between New York and San Juan, but has ordered an investigation of the tariff. Rate is 50¢, 22% lower than regular third-class fare and is available to groups of 10 or more persons.

►New terminal building at Amsterdam's Schiphol Airport will be equipped with telescope program connecting aircraft with loading docks. Building will become operational in 1968.

►Pan American World Airways was to begin the first nonstop service between the West Coast and Tokyo via Hawaii last week. Instead, schedule calls for a once-a-week flight from Los Angeles using a Boeing 707 jet transport.

►Passenger facilities at major Russian airports showed slow improvement during 1965, although completion of major projects at Kiev and Moscow—especially, Dnepropetrovsk Airport—leaving Aeroflot build new airport hotels at Sverdlovsk, Chelyabinsk, Krasnodar and Gorka in 1965. Besides the new passenger terminal at Novosibirsk (AW Dec. 9, p. 41), terminals were opened at Perm and Skrytyevsk.

►United Air Lines has been conducting a sales drive in Japan aimed at stimulating more Japanese tourist travel to the U.S. Carrier estimates that by 1965, some 700,000 Japanese will be traveling overseas with 90,000 of these visiting the U.S.

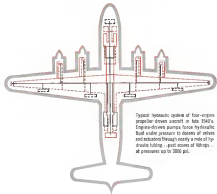


Whatever happened to all those hydraulic fluid fires?

Aftermath of a rejected take off. Skynote® fluid flooded the red-hot wheels—but did not ignite.

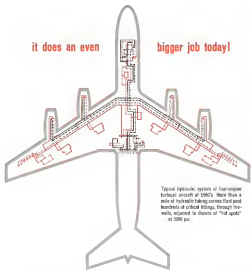


Skydrol took on a big job in 1948...



Typical hydraulic system of four-engine propeller-driven aircraft in late 1940's. Engine-driven pumps force hydraulic fluid under pressure to dozens of valves and actuators through nearly a mile of hydraulic tubing... past scores of fittings... at pressures up to 2000 psi.

There were hundreds of them up to 1948 when Skydrol® was introduced...



Today's aircraft are bigger. Hydraulic systems are more extensive, more complex. More than a mile of hydraulic lines snake through a modern four-engine jet. They run through firewalls, unavoidably close to dangerous "hot spots" ... possible ignition sources.

Hydraulic leaks are going to happen. Spring a leak anywhere in this mile-long mass of tubing, hoses, couplings and fittings, and high pressure forces the fluid out in a finely divided spray or mist. Run this mist past a super-heated brake drum or any of dozens of other possible ignition sources all over the airplane and you've got an explosive situation on your hands.

With flammable fluid in the hydraulic lines, you risk fire, the safety of passengers and crew, the loss of an airplane.

With fire-resistant Skydrol in the lines, you lose a little fluid. That's ALL.

It's an easy choice, and most of the world's major airlines have made the decision for Skydrol.



...but not one since then in a Skydrol-equipped aircraft!

Hydraulic system failures still happen. Leaks still spray hydraulic fluid over super-heated brake drums ... onto glowing exhaust manifolds ... past sparking electrical contacts ... or into dozens of other possible ignition sources. That spells fire when the hydraulic lines carry flammable fluid. But no aircraft equipped with fire-resistant Skydrol has ever been involved in a hydraulic fluid fire. Not one!

Prepared for East. S. Hwy.



GUARANI 2 PROTOTYPE POWERED by two Turbomeca Bastar 5A turboprop engines made its first flight in April.

Argentine Guarani at World Market

By Ward Wright

Cordoba, Argentina—Argentina's first serious attempt to enter the world market with an aircraft of her own design—the Guarani 2 twin-turboprop transport—is well under way with completion of the first steps leading to U.S. Federal Aviation Agency type certification.

The Guarani 2 in standard configuration is a 10-seat transport with a maximum cruising speed of 295 mph, an economical cruising speed of 250 mph, and a stalling speed of 90 mph. The fuselage is unpunished, but the aircraft has a service ceiling of 41,000 ft. and an engine-out service ceiling of 11,000 ft.

Powerplants are French Turbomeca Bastar 5A rated at 310 chp each with 165 ft. radial thrust. Fuel consumption is 34.000 lb. at cruising speed in 45 gph at each engine.

Arg. Gen. Antonio San Juan, Argentine, director of civil aviation recently recommended that his foreign office ask the U.S. State Dept. to authorize the bilateral aviation agreement needed before the certification process can be started.

FAA, before issuing a type certificate to a foreign aircraft, first must state that the country's aeronautical agency is capable of doing that regulation as levels required. Under the agreement, Guarani will be built, for example, to FAA's SR-422 governing turbine-powered transports.

The Guarani 2 was designed by Argentine Air Force Capt. Hector Edwards Ruiz, of Argentina's government-owned, autonomous firm of DINPIA (Direccion Nacional de Investigaciones e Investigaciones Aeronauticas) located in Cordoba. Ruiz is DINPIA's aeronautical engineer in charge of airplane overhaul by the Argentine air force and is chief of the project group of the Military Aircraft Division—air at DINPIA's base near Cordoba.

At present one Guarani 2 is flying

from Buenos Aires and 75 Beechcraft T-31 Mentor trainers.

"Even though it is such a small or more to build an aircraft under license in here, the government took the expense is worth it to keep economical 50% due in Argentina," Edwards said. He added "We have benefited greatly both in knowledge and taking from production under license."

Another reason for the manufacture of aircraft in Argentina, it was pointed out, is the difficulty of obtaining hard money for purchasing aircraft and components from abroad.

Correcting Shortage

The money problem has been solved in various ways, he said. The design of the aircraft is the first production Guarani 2 from New York, it is later this winter or early spring. Although DINPIA makes over part of the Guarani, except engines, instruments, wheels, brakes and avionics equipment, new materials have to be imported. There has been some government delay in allowing money for those items—although 40 Turbomeca engines for the Guarani have been bought.

It is felt that this shortage of cash for needed equipment may soon be corrected. Government believe that the new government of President Arturo U. Ruiz will give a new impetus to the aeronautical efforts of DINPIA in general and the Guarani program in particular. And, as an intermediate organization, DINPIA is free to spend on the Guarani money made on other local and better known in the motorcycle and automobile made by its General Production Division.

Ruiz said he expects the standard 10-seat version of the Guarani 2 to sell



NOSE OF THE GUARANI 2 wings open to expose equipment. Pilot's cockpit is located directly over the engine.

for about \$115,000 complete with avionics equipment and weather radar. Other versions—those for military, ambulance, search and rescue, and aerial photography—will be offered.

After he complete the first series of aircraft, Ruiz said, "we can consider building a pressurized version." Present Guarani will come equipped with liquid oxygen system for high altitude flying.

Foreign Inquiries

The first group of 20 aircraft will not be issued possibly for sale in the U.S. Ruiz feels that FAA certification is necessary for an aircraft to be successful on the world market, but he did not rule out the possibility that DINPIA would allow the aircraft to be built elsewhere under license or to be sold in the U.S. without avionics. They might be furnished by General's Avionics and Engineering Corp. should it receive its license to build Ruston engines.

So far, Ruiz has had inquiries about the Guarani 1 from Central African Airways Corp., Salisbury, South Africa, A. E. S. Flying Co., Pty., Ltd., of Victoria, Australia, and a firm in New Guinea.

Ruiz began work on the Guarani 1 (based for the medium language of the

Panagrasia industry) in 1960 after a request from the director general of DINPIA to study the possibility of installing turboprop engines in the piston-powered 1 A-15 Panagrasia utility aircraft then built by DINPIA.

In reviewing the problem Ruiz and available engines decided a choice between the French Bastar 5A, Turbomeca 1A, and the Turbomeca 1A. Ruiz said he rejected the Guarani because the new location of the engine being getting required a forward-loading power shaft that meant a significant increase in weight forward area.

After the choice of a powerplant Ruiz identified 17 possible areas that would have to be corrected before turboprops could be installed on the 1 A-15 Panagrasia. Staff of the study was construction of the Guarani 1, which incorporated about 20% of the Panagrasia's structural components in choice the first vertical stabilizer and ailerons. Before the last test flight of the Guarani 1 in February, 1962 Ruiz had completed a study of the Guarani 2 incorporating improvements suggested by the actual construction of the Guarani 1.

Principal modifications to the Guarani 2 were installation of the Turbomeca Bastar 5A engines, complete redesign of the tail unit, a new

braking system, a weight reduction program and redesign of fuselage structure in the landing gear to permit positive extension and retraction by ground.

Ruiz said the two 5A and radial tail follows from the Panagrasia but had to be changed because of high speed vibrations and insufficient stability during low engine operation with turboprops. The new modified is a high wing, single vertical stabilizer (reflected) was to compensate for aerodynamic thrust caused by loss of one engine.

Further Modifications

Further modifications included one being the new vertical stabilizer with a fuselage designed variable camber horizontal stabilizer. The ailerons, Ruiz said, a greater aerodynamic efficiency and longitudinal stability. The new tail unit was attached to the old Guarani 1 fuselage which had been shortened 18 in. A plastic facing was added to smooth airflow under the new tail assembly where the fuselage had been shortened.

For an improved braking system, Ruiz said he demanded disc brakes which could stop the Guarani in 300 ft. from 90 mph in an emergency. The avionics also had to be capable of installation without modification to landing gear or nacelle. After certification,



ELECTRIC POWER FOR SPACE

TRW Space Technology Laboratories is building electric power systems using electrochemical, photovoltaic and nuclear techniques. They are being used on America's major space programs, including OGO, Air Force 823 Program and Mariner. Engineers and scientists interested in energy conversion technology, transistor circuit design, electrochemistry and power system engineering should contact STL Professional Placement, One Space Park, Redondo Beach, Calif. Dept. 4-12. TRW is an equal opportunity employer.

TRW SPACE TECHNOLOGY LABORATORIES
THOMPSON RAND WOLFEBERG INC.

tion with U. S., French and British manufacturers, a Douglas building system which met these requirements was selected.

In the weight reduction program, electric counterweights were moved as far forward as the large area is possible to reduce use of lead. Nozzles were redesigned for the Buean (A) engine with an additional weight saving. Passenger seats also were redesigned. Numerous other small modifications combined with the shortening of the fuselage, have accounted for about a 2,000 lb saving.

Since the Gemini 2's maiden flight Apr. 25, the aircraft has flown about 100 hr. The aircraft was formally decommissioned to President John F. Kennedy's Air Force Museum at Dayton, Ohio, last month.

FAA Advice

FAA's regional representative, with headquarters at Boston Area, has been in unofficial contact with the Gemini's leaders to smooth the way to FAA type certification. These informal meetings have led to installation of improved avionics gear in standard equipment and enlargement of escape hatches to conform with FAA regulations.

The test flight program has led to a number of minor modifications, including removal of the point-to-point wiring in the landing gear and burning it in the leading edge of the wing, installation of an automatic fueling device and changes in the angle of stabilizer incidence. After 25 hr of flight the cabin air conditioning was modified to include a vent to dump equipment heat overhead. Since then the air conditioning system has performed correctly. Ruse said.

Easy Cockpit Access

Gemini's slim and structural reason are made of 2024-T3 aluminum alloy. Fuselage is of semi-monocoque construction fitted with a large nose which serves to expose all avionics equipment. Removal of the avionics equipment, which is accomplished with-out tools, in turn gives easy access to cockpit instrumentation.

Standard avionics complement includes two Bendix command trans RA-21A, 100-channel VHF receiver with a frequency range of 105.0 to 115.95 mc; two VHF TA-21A 100-channel transmitter receiving 115.0 to 115.95 mc; one RA-21A RA-11R magnetron receiver; one CSA-3A1 glidepath receiver; one Bendix MK-A 21A marker receiver; two DFAT-2A ADF receivers; two ASA-31A radio gear and one MDR-1E weather radar. Additional equipment will include an HF transmitter KAT-11A, covering 2 to 15 mc.



TWO FOLDING TABLES ARE STANDARD equipment in the 30-passenger executive version of the Gemini. Cabin is trimmed in leather-type material. Soundproofing also is included. Center windows on each side of the cabin look outward for escape in emergency.

Bendix dual VDO/ELS system for use with the RA-21/MNA-21B receiver is offered as optional equipment.

Cockpit layout includes standard flight and engine controls and dual instrumentation. Engine controls are French. Others are Bendix, except for the stabilizer attitude indicator which was designed by Ruse.

Pilot and co-pilot seats are fully adjustable fore and aft as well as fore and aft. Rudder pedals are also adjustable. Seat belts are with inert buttons in the Gemini are of Argentine manufacture.

An overhead escape hatch is provided in the cockpit for pilots to use in an emergency.

Cockpit windshield area totals about 13.5 sq ft.

Luggage space is in compartments behind the cockpit and in the rear of the fuselage. Behind the cockpit, about 4 ft is available between bulkheads on the port side. Opposite space on the starboard side is partially occupied by a small stainless steel galley.

This area is in turn separated from the rest of the cabin by a bulkhead covered with a Farnsworth material made in Argentina. Sliding down re-

leased into the bulkhead permit access to the cockpit.

The 19-ft passenger cabin can seat 10 persons in individual subcabin seats in standard configuration. Ten other projects into the side but is limited by clips and carpeted to measure in convenience. Rear row there are no plans to eliminate the step created by the box, says Ruse. Two folding tables attached to the sides of the fuselage serve facing seats in the rear area of the fuselage.

Passenger Viability

Cabin interior is trimmed in a leather-type material. Soundproofing is achieved with a polyurethane foam material. Three large sliding windows on each side of the cabin give excellent passenger visibility. Center windows on each side now lack out for passenger straps, but before Gemini will have enlarged center windows that will open toward the interior to conform with FAA regulations.

A toilet and a small sink are in a compartment on the starboard side between bulkheads at the aft end of the passenger cabin. Daytime illumination is provided through an overhead dual-



RCA-6521 displays at 300 miles range the information by sea waves, close ahead, indicating that difficult weather conditions exist.

NOW! 4,000 HOURS TUBE WARRANTY

In service as a pulsed oscillator in C-band, the RCA 6521 Magnetron is designed and sized to meet the strict demands of high-speed aircraft. As a basis for new designs, or as renewal in existing weather warning radar, the RCA Magnetron helps assure flight safety by detecting turbulence up to 150 miles away.

The RCA 6521 carries a warranty of 4,000 hours of service—outstanding for magnetrons. (Hours of service are total hours of operation, including time that power is applied to filament or heater.)

This carefully manufactured tube is typical of how RCA continuously is improving standard product designs. Techniques and procedures developed for RCA's work on space satellite programs have been adapted to set new standards of quality in commercially available microwave products.

RCA electron tubes are manufactured to high quality standards and are warranted against defects in workmanship, materials, and construction. If a defect is of a latent nature, it normally will reveal itself shortly after the tube is placed



into service. RCA will allow adjustment for the RCA 6521, subject to terms set forth herein, in accordance with the following: Full adjustment is allowed for RCA 6521 failure within 500 hours of service. Pro rata adjustment is allowed for RCA 6521 failure after 4,000 hours of service. Adjustments are limited to claims presented within two years after the tube was shipped by RCA Electronic Components and Devices.

In the RCA 6521, a line, stands out from the mass of competitive designs, and contributes to an extended life for the unit. Ask your RCA Representative about the RCA 6521. He'll explain how the RCA 6521 means low cost per hour of operation, how the tube's performance will far exceed your money in long-run renewal (7,600 hours MSL at 95% confidence level).

See your RCA Distributor for technical information on this RCA Magnetron by C-band operation. Or write: Commercial Engineering, Section RCA Electronic Components and Devices, Harrison, N.J.

PLEASE USE THROUGH YOUR AUTHORIZED RCA INDUSTRIAL TUBE DISTRIBUTOR



The Most Trusted Name in Electronics



ADJUSTMENT TERMS

1. Adjustment will be limited to claims which are presented promptly after tube is found to be defective.
2. All tubes claimed to be defective will be subject to inspection and test by RCA.
3. Tubes returned to RCA will be considered for adjustment only if return was authorized by RCA and made in accordance with instructions issued by RCA.
4. RCA will be responsible for transportation costs on returned shipments provided shipment is substantially insured. RCA, however, cannot accept claims for post-lag, inspection, or labor costs in connection with tubes returned for inspection or adjustment.
5. In all cases, RCA reserves the right to make adjustment by repair, replacement, or credit, when full adjustment is available, adjustment usually will be made by replacement as listed by RCA reserves the right to limit the adjustment noted on the replacement tube to the unexpired portion of the original tube warranty. When pro rata adjustment is allowed, adjustment will usually be made by the issuance of credit.
6. Adjustment credits will be based on prices in effect at date of claim for adjustment.
7. Representatives for tubes found subject to adjustment will be charged \$100 city or out-of-town with transportation charges present by RCA at city of contention.
8. Adjustment will not be allowed for tubes which have been subjected to abuse, improper installation or application, excessive vibration or neglect, or use, storage, transportation, or handling not in accordance with original manufacturer's packages have been damaged, altered, or modified.
9. Full determination as to whether any adjustment is allowable rests with RCA.
10. No warranties or obligations on the part of RCA Electronic Components and Devices other than the above-stated, are to be implied with respect to standard tubes, and RCA cannot be responsible for later or any other changes in available tube life or replacement of standard tubes.

DINFIA Guarani 2 Model LA. 50

Performance

Max speed	310 mph
Max cruising speed	290 mph
Economy cruise speed	260 mph
Stall speed	90 mph
Loaded rate of climb	2,600 fpm
Service ceiling	40,000 ft
Service ceiling, one engine	31,000 ft
Takeoff distance over 50 ft obstacle	2,300 ft
Landing distance over 50 ft obstacle	1,670 ft
Range with max fuel	1,550 mi
Range with max payload	1,340 mi

Specifications

Empty (unpainted)	5,690 lb
Max, parked	5,690 lb
Max, loaded weight	15,700 lb
Wing span	63 ft 9 in
Overall length	46 ft 9 in
Overall height	21 ft 9 in
Gross wing area	493 sq ft
Propellers	two Teichmann Bristol 650 rated at 930 shp and 161 ft
crushed thrust	
Total fuel capacity	100.47 U.S. gal.
Fuel burn tank capacity	85 gal each
Oil capacity	16 gal each
Passenger (including to water)	16, 12 or 15

light in the starboard side of the fuselage compartment.

Port side door opposite the lavatory access is an exit leading from the lavatory door. The door is equipped with a self-actuating slung-in the passenger cabin. It is hinged at the bottom and closes upward.

Cabin Air Conditioning

Cabin air conditioning unit is an automatic 15 ton French SIEMENS installed in the lower fuselage beneath the forward baggage compartment. Inlets for the air conditioning are located in the port side of the lower fuselage below the pilots side window.

Flight controls and hydraulic lines are readily accessible without touch through four low resistance access air passages on the underside of the fuselage near the edges. When open, the covers expose several feet of push-pull line and hydraulic piping. The air exposed is drawn up into a line 2 ft ahead of the leading edge of the wing to slightly behind the leading edge.

Partitions around the covers were designed by RCA to fit flush with fuselage in flight. When closed, the covers are opened by placing the fingerpin in slight indentations provided and turning them. When unlocked, the panel goes down into the unlocked position and the inspection covers can be removed.

Two-piece landing gear is forward retracting with a self-lifting fuselage

Each main gear is fitted with two Dunlop wheels mounting tabs 7.50 x 13 tire. Nosewheel tabs are 5.50 x 10 Dunlop tire. Wheels can be lowered by gravity in an emergency with an inert force about 145 lb of aerodynamic drag on the main gear at 100 mph. Shocks are of the oleo-pneumatic type.

Wings are of single box spar construction with a main spar attached behind the box. The Guarani employs a straight section from the wing root extended beyond the main spar where the wing spar is joined. This design allows a shorter gear permitting it to be attached into the smallest possible fuselage.

Fuel is stored in the area between the box spar and the leading edge in the dihedral section of both wings. Fuel capacity is 260 gal of JP-1 in each wing. Rate and the dihedral section of the wings have been designed to draw away from the straight wing section in an accident.

Optional Tip Tanks

Optional glass fiber tip tanks of about 20 gal capacity each will be added for production aircraft. Tip tanks will provide an additional 1 hr 45 min flying time extending total flying time from around 5 hr to nearly 7 hr, RCA said.

Aluminum self-lubricated, fabricated Finetips. They are operated by push-pull line and incorporating

MIT/RAYTHEON STATUS REPORT:

APOLLO Guidance Computer



Ralph Rosen (left), Manager of Raytheon's Guidance Operations, and Eldon Hill, Director of Apollo Computer Division, MIT Instrumentation Lab, inspect on-board guidance computer for Apollo mission.

Predicted Reliability Increased More Than 2:1 ... Contract On Schedule

By incorporating the latest core memory module and integrated micrologic techniques into Apollo's on-board guidance computer, the MIT/RAYTHEON team has doubled predicted reliability of the system with no loss in scheduling time.

Drawing upon a background of successful joint effort in developing the reliable Mark 2 Polaris missile guidance computer, the MIT/RAYTHEON team is striving for similar fault-free operation of its Apollo guidance system. The operating computer, less than 1 cubic foot in size, will provide mid-course navigation and guidance data for NASA's Apollo spacecraft mission.

The MIT/RAYTHEON-developed computer contains an extremely dense, low-powered, fixed memory of 5,000 bits/octet inch. In flight, the astronaut will operate the computer through a 16-button coded keyboard. In case of input error or an "unacceptable" order, a light will warn the astronaut to erase the error. When the command is correct, he pushes an "enter" button and the computer will take over, using signals fed to it automatically from the other subsystems in the craft.



Keyboard for Apollo's on-board guidance computer.

The working relationship of the MIT/RAYTHEON team in developing and producing the computer, its displays and keyboard, and its pre-flight ground support equipment, represents truly unique capability in space age guidance and control. Space and Information Systems Division, Sudbury, Mass.



It takes an "electronic pencil" like MODICON® world's only in-being, automated, globally-wireless, rail, mobile air weapons control system for air defenses and air defense operations through control of missile weapons. Really portable and maneuverable by military personnel, the system meets with command requirements for air defense, air superiority strike, interdiction, close air support, reconnaissance, air traffic control, surveillance, and mobility. Compactly packaged in a transportable form suitable for helicopter or vehicular applications. Complete system fits only three C-130A cargo transports. Successfully field tested and evaluated for two years by the military. Major development and other non-recurring costs paid. A proven, future-proof, minimum-use-life system available at production prices and schedules.

YOU CAN'T PLOT MACH-2 AIRPLANES WITH A GREASE PENCIL



"Modular Dispersed Control"

YOU CAN'T PLOT

MACH-2 AIRPLANES WITH A GREASE PENCIL



GUARANTY PROPERTIES POWERED by Toulouse-based Via first flew in February, 1962. Then for real relief of aerial harassment was accepted to improve strategic mobility. Before first test flight, project engineers had completed a roundup of the Guiana 2 incorporating improvements already considered necessary to the first version.

area data. Hydrocarbon's actuated split gear control landing speeds.

Adapted to NACA's 631-118. Aspect ratio is 9. The wing is cranked for stall stability with a 3 deg angle of incidence at the root tapering to 1 deg at the tip. It has no sweepback. Total wing area is 5,500 sq ft. at Mach 2.0. Total flap area is 2,493 sq ft. Cruise wing area is about 450 sq ft.

Four Air Intakes

The nacelle incorporates a pilot which diverts air around the engine and exhaust to keep temperatures within the usual wall from damaging heat. Four air intakes for the air intake are spread around the nacelle behind the propeller hub.

On each side of the nacelle, in the straight section, are inspection covers on the underside of the wing back from the leading edge. These are hinged from the front and opened by distance developed by Ruz. The intakes are designed so they can be opened without the flap but in flight are held closed by mechanical or self in zero clearance position.

Automatic Feathering

Inspection cover on the underside of the nacelle permits access to the intakes while the aircraft is in flight. When the aircraft is in flight, the cover is closed by a spring mechanism.

Population for 511 French Rotor-Figures 714 560. Thus feathering system is automatic and the propeller has a built-in spring mechanism. Feathering and built-in can be controlled from the cockpit by controls.

Blades can be started from ground power or the Guiana's French Rotor-Figures 714 560. Thus feathering system is automatic and the propeller has a built-in spring mechanism. Feathering and built-in can be controlled from the cockpit by controls.

The movable consists of a variable incidence horizontal stabilizer which through +2 deg. to -1 deg. to control

trim. Incidence is varied by an electrically actuated screw mechanism. Ruz says the angle of incidence is such that the aircraft can be controlled with the stabilizer in any attitude in an even gency. Elevators fitted to the stabilizer incorporate balance tabs to meet operation.

Vertical tail area is 60.5 sq ft. with a geometric aspect ratio of 1.75. Sweepback is 51 deg. 10 min. Root chord is NACA 0006. Horizontal tail area is 79 sq ft. with a geometric aspect ratio of 6. Horizontal stabilizer is 21 deg. 30 min. Aerial is the same in the vertical stabilizer.

While the present Guiana 2 is not fitted with firing equipment, production models will be equipped with French Kleber-Columbus and other pneumatic hot type firing equipment.

Three Firms Report Officer Compensation

Washington—Following is a list of aerospace industry directors and officers with 1962 salaries above \$50,000, and their stockholdings, as they were reported to the Securities and Exchange Commission.

Convair Corp. an Atlantic, Inc.—P. J. Fiedler, president and treasurer, director, 579,362.10 shares. \$5,400.75 per share paid to the company as life insurance policy (annual dividend of \$1,000) payable to Mr. Fiedler's family, 775,146.75 shares of common stock. J. D. Barnes, Washington representative, director, 1,011 shares of common stock. N. Kunkin, secretary and director, 1,366 shares of common stock. W. C. McVahon, assistant secretary and director, 180 shares of common stock. W. J. Rader, Jr., director, J. C. Wells, director, W. S. Jones, Jr., director, G. M. F. Magley, Jr., director. All salaries begin on Jan. 1. First year ending Apr. 30, 1963. All directors were elected Mar. 19, 1963. For the

year ending Nov. 30, 1963. All stock is \$1 per share common stock, issued at stated or face value as of Aug. 15, 1963.

International Business Machines Corp.—R. Barclay, director, 140 shares of stock, 51 shares of stock owned by members of Mr. Barclay's family, 516,975 paid to the firm of Corbitt, Brown & Moore, in which Mr. Barclay is a partner, in fee for legal services performed during 1962 for the company. W. G. Buckner, director, 4,000 shares of stock, 52,211 shares of stock owned by members of Mr. Buckner's immediate family and family trust, P. L. Deen, director, 240 shares of stock & M. Farnell, director, 119,636 shares of stock, 368 shares of stock owned by family trust purchase of supplies and equipment for the computer from Fairchild Controls and Instrument Corp., Fairchild Brown Corp., and Fairchild Scientific Instrument Corp. of which Mr. Farnell is chairman of the executive committee and the family trust. Total compensation for 1962, \$54,590.68. In 1962, C. C. Butler, director, 922 shares of stock, 562 shares of stock owned by members of Mr. Butler's immediate family, G. K. Kline, director, 121 shares of stock, 10,000 shares of stock, L. H. LaMont, director, 11,729 shares of stock, 7,934 shares of stock owned by family trust of Mr. LaMont's immediate family, J. V. Lerner, vice president and group executive, director of I. B. M. World Trade Corp., director, 1,011,000 shares, 540.25 percentage compensation for 1962, 2,591 shares of stock, 119 shares of stock owned by members of Mr. Lerner's immediate family, W. H. Moore, director, 100 shares of stock, J. C. Phillips, director, 31,477 shares of stock, 7,166 shares of stock owned by members of Mr. Phillips' immediate family, E. P. Ryan, vice president and group executive, director (elected 1962), 577,207 shares, 1,451 shares of stock, 2 shares of stock owned by members of Mr. Ryan's immediate family, G. H. Schmitt, director, 117 shares of stock, 120 shares of stock owned by family trust, A. S. Whitman, vice president and group executive, president and director of I. B. M. World Trade Corp., director, 52,143 shares, 348,865 percentage compensation for 1962, 51,212 shares of stock, 42,986 shares of stock owned by members of Mr. Whitman's immediate family and family trust, J. L. Whitman, Jr., director and chairman of the board, 164,000 shares, 514,790 percentage compensation for 1962, 11,375 shares of stock, 35,176 shares of stock owned by members of Mr. Whitman's immediate family and family trust, 1,355 shares, 517,645 percentage compensation for 1962, 7,094 shares of stock, E. E. Ford, director (elected Mar. 6, 1963), 1,011 shares, 1,011 shares of stock, 11,496 shares of stock. All stock owned as of Jan. 31, 1963.

Spartanair Corp.—R. F. Olson, president, director, 50,000 shares, 50,000 common shares owned during 1962 to retirement plan 15,490 shares of common stock, 2,700 shares of common stock, 1,000 shares of common stock, L. H. Schmitt, vice president, director, 540,000 shares, 34,936 common shares owned during 1962 to retirement plan, 5,216 shares of common stock in accordance with the terms



We bet he grew up to be an engineer in one of the 18 aerospace centers we serve

Chances are the boy above has grown up in your industry. But he might have become one of the many United Air Lines pilots who fly you to the aerospace centers where you do business—we serve more of these than any other airline.

Besides this service to aerospace centers, we offer you the convenience of more jets to more cities all across the U.S. than any other airline, along with a genuine concern for customers as people. For these and many other reasons, more people choose United than any other airline in the world.



Satellite Vehicle Undergoes Vibration Testing

Replicate scientific payload prototype of the Sate (satellite for aerospace research) vehicle is suspended into a vibrator at General Dynamics/Armstrong to undergo testing. Sate is designed to provide space-orientation platforms (NAV) 15 to 95, carrying a 100-lb. payload into an elliptical orbit with a 300-mi. apogee, or a 300-lb. payload into a 100-mi. circular orbit. Note hemispherical dome configuration of solar cells.

of an employment contract entered into by the company on May 1, 1959. Mr. Schmitt will be immediately employed by the company as an executive assistant until he retires on or after Dec. 31, 1964, at an annual compensation of \$40,000 and will continue to be employed as a consultant capacity during his retirement at a company salary equal to \$1,500 per month (the contract also provides for various payments to be made during her life in the event of Mr. Schmitt's death). G. J. Lamberton, General Counsel and Secretary, advised the \$18,500 salary, \$2,500 company contribution during 1962 to retirement plan, 5,162 shares of common stock, or interest rate of 1.794 shares of common stock, or interest rate with the terms of an employment contract entered into by the company on May 1, 1959. Mr. Lamberton was immediately employed by the company as an executive assistant until he retires on or after May 1, 1965, at an annual compensation of \$1,800 per month (the contract provides for optional payments to be made during her life in the event of Mr. Lamberton's death). R. A. Gorman was provided in charge of capital goods operations director

\$51,000 salary \$4,125 company contribution during 1962 to retirement plan, 5,611 shares of common stock, interest of a bond which was 91 shares of common stock. J. W. Edwards, treasurer and controller, director \$40,000 salary, \$1,000 company contribution during 1962 to retirement plan, 5,162 shares of common stock, G. L. Jeffers, Jr., vice president in charge of sales and defense products, director (October 1961) 2,136 shares of common stock, director of 11 shares of common stock for service stock. T. N. McGowan, chairman of the executive committee, director 2,142 shares of common stock, R. C. DeLong, director, 1961 shares of common stock, director of 25 shares of common stock for his minor children A. A. Holroyd, director, 5,102 shares of common stock, partner in the firm of Holroyd, Wagon, Allen-Sells was \$45,000 salary for the company which received from of \$44,000 during 1962 for legal services. R. H. Mack, director 511 shares of common stock, president of Howard B. Mack & Associates, Inc., all existing contracts, which received from the company for of \$70,515 during 1962 for services, all stock beneficially owned as of Feb. 18, 1961.



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Total Eclipse Observation Route Plotted

Route of a proposed eclipse observation expedition to photograph the next total eclipse of the sun, expected May 30, 1965, is outlined on a chart prepared by Douglas Aircraft Co. for a recent symposium at Los Angeles, Calif. It was suggested that the expedition use a Douglas DC-6 in the observation. The DC-6 would fly an 8,000-mile path following the eclipse sun east by the moon. The expedition, directed by Douglas and the National Geographic Society, observed the last eclipse, July 29, over northern Canada from another DC-6. An overcast night on May 29 might need two surface ships with buoys to guide the aircraft to the proper point for observation. Douglas said the observation time of a total eclipse could be increased from 5 1/2 min. on the horizon to 6 1/2 min. from an aircraft. Path of the shadow follows a route from New Zealand past the Samoa Islands and Tahiti to Kamoharui.

Navy Launches Second DAC-Roc In Rocket Probe Test Series

Los Angeles — Douglas/Lockheed, pending solely, launched Dec. 10, was the latest in a series of evaluation tests the Navy is conducting before selecting rocket probes for use in international part of the quiet sun projects.

Most recent of the series, which are being made at the Naval Missile Facility, Ft. Aguila, Calif., was the second of three planned for the probe, designated DAC-Roc by the Navy. Douglas Aircraft Co., Inc.'s, Chatsworth, N.C., is a prime contractor and aerospace manufacturer, and Lockheed Propulsion Co. is propulsion subcontractor for the probe.

The sub-orbital rocket is one of a group of five competing for a production contract as the Bureau of Naval Weapons program.

The Naval Missile Center, 76 Mugu, Calif., is assigned the evaluation work leading to the production award which is expected to involve several hundred vehicles.

Powered on the second DAC-Roc shot,

conducted by a Navy guided missile unit, consisted of telemetry measurements to measure performance data. These scheduled shot is tentatively set for late January.

The Douglas/Lockheed system is a single-stage, established ballistics rocket designed to carry a 25-lb. payload to an altitude of 100 mi. and in an aspect angle close to 100 mi. downrange. Lockheed is offering a version of its fourth motor for the DAC-Roc probe, which is 154 in. long and 9 in. in dia. and produces a total impulse of 90,000 lb./sec. The rocket is 187 in. long, and weighs 575 lb.

Other competitors competing for the production contract and their respective names are Allstate Research Corp.—Anchor Rocket Power; Ico—Thunderbolt; Thakol Chemical Corp.—Sagittar; and Canadian Bristol Aircraft Ltd.—Black Bone 3. Arbutus, Thunderbolt and Black Bone have been fired twice in the Navy tests. The Sagittar has been fired once.

Life Support Capsule

Los Angeles—An experiment in which a chimpanzee was kept for over eight days in simulated space environment conditions indicates that a life support capsule under development by the Air Force Space Systems Div. could be added to anti-earth orbit capability of some 14 to 30 days, depending on payload and other versions.

The life support capsule, designed and built by Lockheed Aircraft Corp.'s Missile & Space Co. Div., was recently tested at the Lockheed Sunnyvale, Calif., facility using an specially equipped UNIV ground checkout trailer van, including a vacuum chamber into which the capsule was placed.

An Air Force official said the life support system is being developed for use in future school experiments including tests of the effects of extended weightlessness on primates.

Principal hardware involved in capsule modification would be the addition of more carbon dioxide absorbers (Mikuns hydroxide) and a decrease in water absorbent capacity. The capsule utilizes an environmental control system fabricated by the Garrett Corp.

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Production schedule for Beech Aircraft Corp.'s AQM-37A high and low-altitude target drone calls for 400 in 1964. Target has been flown 18 times since May by the Navy, which has placed a \$30.4 million order with Boeing's Aerospace Division. In final assembly (above, left) targets are directed into electronic sensors and checked. Bombed, however, wings are important in design. Final electronics checked in on a production line basis (above, right). First flights of AQM-37A from USS Midway jets included separate launch for gunnery practice.

Beech AQM-37A Output to Reach 400 in 1964



Final total wiring procedure ends after air-surface testing on B-70 target tests with liquid propellant. Duplicate design review and testing calls are on either side of the station to separate the hydroplanic simulation of fuel and oxidizer.



Fluor coating protects target against oxygen while oxidized and firing. Nitric acid is loaded by metal factors whose back packs contain liquid oxygen for burning and cooling. Leakage in shipping conditions is signalled by red or blue indicators.

Department of Defense Lists Top 100 Prime Contractors for Fiscal 1963

The 1982 campaign which recorded the **largest dollar volume of military prizes** amounted to \$165,000 or more in fiscal year 1982 (terminated by 72.7% of the initial States sent). This is an increase of 1.6 percentages over the 1981 campaign. The 1982 campaign also recorded the **largest number of prizes** given from the 38.2% prize in fiscal year 1982. As has been mentioned in previous reports, a substantial part of the prizes consist of cash prizes on the 14th campaign for a substantial part of the year. However, almost all of the prizes are cash prizes. The 1982 campaign also recorded the **largest number of prizes** given from the 38.2% prize in fiscal year 1982. As has been mentioned in previous reports, a substantial part of the prizes consist of cash prizes on the 14th campaign for a substantial part of the year. However, almost all of the prizes are cash prizes.

Per Card of W. & T. Total

COMPANIES	FF 12/9	FF 12/9	FF 12/9	FF 12/9	FF 12/9	FF 12/9
East	9.8%	7.8%	4.0%	4.0%	3.0%	3.0%
West	4.4	3.1	1.1	1.1	1.1	1.1
Mid	3.1	4.1	4.1	4.1	4.1	4.1
South	3.1	4.1	4.1	4.1	4.1	4.1
North	3.1	4.1	4.1	4.1	4.1	4.1
1-6	26.3%	26.3%	26.3%	26.3%	26.3%	26.3%
7-12	12.1	12.1	12.1	12.1	12.1	12.1
13-18	12.1	12.1	12.1	12.1	12.1	12.1
19-24	12.1	12.1	12.1	12.1	12.1	12.1
25-30	12.1	12.1	12.1	12.1	12.1	12.1
31-36	12.1	12.1	12.1	12.1	12.1	12.1
37-42	12.1	12.1	12.1	12.1	12.1	12.1
43-48	12.1	12.1	12.1	12.1	12.1	12.1
49-54	12.1	12.1	12.1	12.1	12.1	12.1
55-60	12.1	12.1	12.1	12.1	12.1	12.1
61-66	12.1	12.1	12.1	12.1	12.1	12.1
67-72	12.1	12.1	12.1	12.1	12.1	12.1
73-78	12.1	12.1	12.1	12.1	12.1	12.1
79-84	12.1	12.1	12.1	12.1	12.1	12.1
85-90	12.1	12.1	12.1	12.1	12.1	12.1
91-96	12.1	12.1	12.1	12.1	12.1	12.1
97-100	12.1	12.1	12.1	12.1	12.1	12.1

The list for fiscal year 1993 includes 17 companies which did not appear in the fiscal year 1992 list. Most of the new names appear toward the end of the list, but two companies obtained a rank within the first fifty. These are Martin Marietta & Scott Corp. with contracts totaling \$149.5 million in late position, and Unitedstar Corp. with contracts totaling \$91.3 million in 47th position.

□ **Key:** half of 1 = comparisons were assigned to whole-body, above and belowwater work. The contrast work of 1 group of the group was identified more than one major community category. Based on the change in temperature, the largest data values of 100000 were awarded to each comparison. There were 22 whole-body, 17 above and 12 belowwater. From the remaining 41 comparisons, full fish the following categories: parasites 910, carrier 91, tail autotomies 91, amputation 91, slips 71, locomotion 30, and sensory evaluation 30.

*This listing the additional and composite institutions on the Bond year 1942 list of large prime contractors are included on the fiscal year 1942 list. The group is comprised of the following: Massachusetts Institute of Technology, Johns Hopkins University, Aerospace Corp., System Development Corp., and Milvex Corp. These composite contractors are generally providing research, development and testing services to the atomic-energy and related programs.

Five companies received prize contract awards of more than \$1 million each in fiscal year 1982. These companies and a brief description of their most significant contract work are as follows:

The Lockheed Aircraft Corp. led the bid for the second consecutive year, winning \$2,012 million, or 33% of the total. The aircraft manufacturer also has the C-130J Super Hercules for cargo transport, C-130J Hercules for cargo and transport, F-16A Fighting Falcon fighter, F22 Raptor fighter, F35 Lightning fighter, F35 Lightning fighter, F35 Lightning fighter, and the F35 Lightning fighter. It is a joint venture project for the F35 Lightning, the Lightning series of general-purpose fighters, the F35 Lightning fighter and other aircraft variants. The company and its subsidiaries also produce aircraft for the military and civilian markets.

[illegible]

B. United Airco B-Corp.,

6. McDonald's Restaurants Corp.	499.6	1.9	33.4
10. Sperry Rand Corp.	462.3	1.7	34.1
11. General Motors Corp.	444.0	1.7	28.8
12. General Time & Rental Co.	3.3	—	—
Aeromat Gulf Corp.	2.8	—	—
American General Corp.	438.8	1.8	—
American Insurance Corp.	1.9	—	—
Spartan Chevrolet Corp.	1.1	—	—
Total	434.4	1.8	27.4
13. Grumman Aircraft Engineering Corp.	230.2	1.8	25.9
14. Douglas Aircraft Co., Inc.	200.7	1.4	—
Total	391.1	1.4	49.3
15. Radio Corp. of America	228.4	1.3	—
RCA Electronics, Inc.	—	—	—
Total	228.4	1.3	45.0
16. Westinghouse Electric Corp.	922.0	0.9	43.3
17. Hughes Aircraft Co.	211.9	0.9	44.3
18. Raytheon Co.	270.0	0.3	—

Rank	COMPANY	AMOUNT OF FINANCING IN \$ MIL.	PER CENT TOTAL	COMPARISON OF '81 TO '80
	Microsoft International, Inc. Trans-III Corp.	3.0 0	0	
	Total	194.9	1.3	45.8
19	Bangla Corp. Bentley Field Engineering Corp. Bentley Manufacturing Associates Air-Brake Co. Bentley Chemicals, Inc. Sheffield Corp.	335.1 0 0 0 0 0	0 0 0 0 0	
	Total	335.1	2.1	44.3
20	International Telephone & Tele- graphs American Cable & Radio Corp. Perfection Radio Corp. General Controls Co. International Radio Corp. RT Communications Systems, Inc. ITT Spacnet Corp. ITT Amer. Communications, Inc. Jennings Radio Mfg. Corp. Radio Laboratories, Inc. Radio Shack Corp. Supersound Mfg. Co.	142.9 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	
	Total	142.9	1.0	47.2
21	Amc Corp.	221.1	1.0	47.3
22	Global Chemical Corp. Chemical Industries, Inc.	203.5 0	0.9 0	
	Total	203.5	0.9	49.2
23	Pand Audio Co. Palm Corp.	216.4 123.1	0.9 0.6	
	Total	339.5	0.9	50.1
24	Harper Co. Harcis Co.—communications Equip- ment Inc.	151.1 36.9	0.8 0.2	
	Total	188.0	0.9	51.0
25	Harvard News Shipbuilding & Dry Dock Co.	211.0	0.8	51.6
26	King/Donahugh, Inc. Altec Communications, Inc. Adco Low-Cost Corp. Commercial Electronics Mfg. Co. Continental Electronic Sys- tem, Inc. P.F.A. in Electronics, Inc. Kendall Research, Inc. Tanner Electronics & Audio Co. Honey Electronic Display Sys- tems Stereosystem Laboratories, Inc.	181.9 0 0 0 0 0 0 0 0 0	0.8 0 0 0 0 0 0 0 0	
	Total	181.9	0.8	52.0
27	International Business Machines	208.9	0.8	

RANK	COMPANIES	ASSETS OF \$000,000	PER CENT OF NET TOTAL	QUALITY % OF \$5 TOTAL
	City	203	0	
	Service Bureau Corp.	0	0	
	Total	203	0	21
23	P. H. C. Corp.	199	0	54
24	Union Industries, Inc.	4	0	
	Amco-Spartan Corp.	4	0	
	Amcor Inc.	6	0	
	Emcor, Inc.	1	0	0
	Joseph Sheikhsolid Corp.	543	0	7
	Union-Spartan Sales Corp.	3	0	
	McIntire Products Corp., Inc.	1	0	
	Waco Systems, Inc.	31	0	0
	Westminster Corp.	0	0	
	Waters (Including Madison			
	Co. Inc.)	0	0	
	Waco-Spartan Corp.	0	0	
	Westcoast Chemical Co. of			
	Atlanta	0	0	
	Westcoast Corp.	0	0	
	Total	587	0	21
26	Republic Machine Corp.	164	0	55
27	Cleaver Corp.	134	0	23
28	Hoveler Powder Co.	132	0	52
29	Aluminum-Household Reap-			
	er Co. Inc.	120	0	57
30	Marble-Clay and Brick Corp.	4	0	
	Shaw & Reynolds Co.	3	0	
	Clayton, Inc.	1	0	
	New York Shipyards Corp.	143	0	
	Total	317	0	58
31	General Telephone & Elec-			
	tronic Corp.	0	0	
	Automatic Electric Sales Corp.	1	0	
	General Telephone & Elec-			
	tronic Electric Co., Inc.	1	0	
	London Electric Co., Inc.	7	0	
	Sylvania Electric Products, Inc.	150	0	
	Total	168	0	59
32	International Oil Co. (New Jersey)	0	0	
	Int'l International, Inc.	77	0	2
	East Kentucky & Georgetown			
	Co.	3	0	
	New Brunswick Electric, Inc.	29	0	
	Seven & Butler Oil Co.	73	0	2
	Wapahic Oil & Refining Co.	0	0	
	Total	157	0	59
33	Pro American World Airways, Inc.	154	0	40
34	Texton, Inc.	3	0	
	Accessory Products Corp.	0	0	
	Texton Corp.	14	0	0
	Texton Youth Co.	0	0	
	Wester Metals, Inc.	0	0	
	Wester, Inc.	0	0	
	Wester Printing, Inc.	0	0	
	Wester, Inc.	0	0	
	Total	18	0	0

Continued on p. 40

RANK	COMPANIES	MILIONS OF DOLLARS	% OF U. S. TOTAL	CUMULATIVE % OF U. S. TOTAL	RANK	COMPANIES	MILIONS OF DOLLARS	% OF U. S. TOTAL	CUMULATIVE % OF U. S. TOTAL	RANK	COMPANIES	MILIONS OF DOLLARS	% OF U. S. TOTAL	CUMULATIVE % OF U. S. TOTAL	RANK	COMPANIES	MILIONS OF DOLLARS	% OF U. S. TOTAL	CUMULATIVE % OF U. S. TOTAL		
	Tenneco Co.	8.2	4			48	Remington Corp.	74.8	3.8			National Oil & Shipbuilding Co.	2.3	4		85	Alle-Drexler Ind. Co.	29.4	6.1		
	Total	161.3	8.6	85.9			Total	77.8	4.0	65.0		Total	47.2	9.2	69.1		Consolidated Systems Corp.	31.3	6.4	73.6	
29	Callaghan Co.	146.3	8.6	81.5		49	Amesbury Corp.	73.5	3.8	65.5		46	de Pont (H. J.) de Housay & Co.	18.4	4		87	Southland Corp.	18.8	6.1	
40	General Precision Equipment Corp.	8.9	4			50	Goodyear Tire & Rubber Co.	33.6	1.6				Southland Aircraft Service Corp.	8.2	4						
	G. P. Carter Co., Inc.	136.4	8.6				Goodyear Aircraft Corp.	32.2	1.5				Total	37.9	9.2	69.1					
	General Precision, Inc.	8.7	4				Total	73.7	3.7	66.6		47	Standard Oil Co. (Indiana)	8.1	4						
	Griffin, Inc.	8.7	4										American Oil Co.	48.6	10.3						
	Harold Thelen Supply Co.	7.9	4			51	Marathon Ind. Inc. of Tulsa	70.8	3.4	67.9			Amoco Chemicals Corp.	2.9	4						
	Smith, Brown, Corp.	7.9	4										Total	41.6	10.3	67.6					
	Total	151.4	8.5	85.0		52	Matheson Steel Corp.	68.8	3.2				48	Essex Aircraft Corp.	44.4	9.7	67.7				
41	Tenneco Inc.	61.4	3.2				Matheson Steel Co.	68.2	3.2				49	Boeing Aircraft Corp.	44.2	9.6	67.8				
	Curtis O. Products Co. ¹	59.0	3.2				Matheson Steel Corp.	68.2	3.2				50	Boeing Aircraft Corp.	44.2	9.6	67.8				
	Colfax Products, Inc. ²	8.2	4				Total	68.4	3.2	66.2			51	Wiley Motor Co.	44.0	9.6					
	Jefferson Chemical Co.	8.2	4											Clayton J. Miller Truck Co.	1	4					
	Pennaco Oil Co.	7.1	4			53	Hepco International Corp.	67.1	3.2	66.3			52	Wiley Motor Co.	44.0	9.6					
	Tenneco Equipment, Inc.	54.1	3.1											Clayton J. Miller Truck Co.	1	4					
	Tenneco Equip. Inc.	54.1	3.1			54	Shell Chemicals Petroleum Co.	37.8	1.8					Total	44.0	9.6	70.1				
	Tenneco Equip. Inc.	54.1	3.1				Shell Chemicals Petroleum Co.	37.8	1.8												
	Tenneco Equip. Inc.	54.1	3.1				Shell Chemicals Petroleum Co.	37.8	1.8												
	Wiley Motor Co., Inc.	54.1	3.1				Total	66.5	3.2	66.8			71	System Development Corp.	48.9	10.7	70.3				
	Total	156.2	8.2	82.3		55	International Harvester Co.	47.8	2.3				72	Continental Oil Co.	34.4	7.5					
42	Standard Oil Company (Indiana)	43.4	2.2				International Harvester Co.	47.8	2.3					Briggs & Stratton Co.	1	4					
	American Standard & Supply Co.	43.4	2.2				International Harvester Co.	47.8	2.3					Briggs & Stratton Co.	1	4					
	Callaghan Co.	43.4	2.2				International Harvester Co.	47.8	2.3					Briggs & Stratton Co.	1	4					
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	Callaghan Co.	43.4	2.2				International Harvester Co.	47.8	2.3					Briggs & Stratton Co.	1	4					
	Callaghan Co.	43.4	2.2				International Harvester Co.	47.8	2.3					Briggs & Stratton Co.	1	4					
	Callaghan Co.	43.4	2.2				International Harvester Co.	47.8	2.3					Briggs & Stratton Co.	1	4					
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spin, despite more than 2000 rpm was applied and the landing gear was retracted with retraction of the flap to 29 deg. The nose of the aircraft was rotated upwards in between 3 to 5 deg above the level position. The control approach procedure was initiated about 1,000 ft. beyond the 125 barometer point to the left of the runway altitude about 21 ft.

Termination of the second approach procedure by the crew of EAL 512 necessitated a turnback to autonomous reference due to the loss of visual reference. This had to be accomplished at an extremely low altitude. There was little time or margin for error if the maneuver was to be successfully accomplished.

Fog Retraction

The DC-77 aircraft in the trailing configuration was to be repositioned from the leading altitude to a check no lower than 400 ft. In order to accomplish this, altitude gain, or even climb, was required. Altitude control to approximately a 540 ft. above altitude in segment. The retraction of flap to 18 deg. during such a transient requires an actual extension to the flap to compensate for the loss of lift at the flap as retracted. Reversing personnel did not experience the movement of the flap which would have resulted from aircraft rotation 10 deg. during change the crew's extension of the flap. The ground control pilot from the tower did not realize a 10 to 15 deg. change altitude.

The extent of power application and the degree of actual rotation and the crew of EAL 512 should have been adequate to accomplish the pullback, but the flap and crew remained extended. However, more than 10 deg. of rotation was accomplished in establishing a positive rate of climb, after use of two thrusts by the crew would have produced the aircraft setting into the ground.

A full-throttle altitude rotation, commensurate with the power applied, would have resulted in the aircraft altitude. The flight controller (first altitude) and the crew rotation did not affect due to a lack of adequate information, statistics, and the additional power was not requested, or delayed because of other delays.

Probable Cause

The Board determined the probable cause of the accident was the inadequate control by the crew during abandonment of the approach which fog conditions did not adequately assist.

Recommendations

Following this accident the Board sent recommendations to the FAA and the United States Weather Bureau. These recommendations and the response letters were as follows:

1. It was recommended that the Air Traffic Control procedures require the transmission of all questionably significant weather information to terminal area in approaching aircraft. The FAA, by later letter Jan. 6, 1962, stated that the necessary procedural changes were being prepared.

2. It was recommended that the RVR information be in the readily accessible instrument IFR room of the terminal tower was

inadequate. Also the Board reported a number of the accident circumstances in all towns where RVR is installed. On Jan. 13, 1962, the FAA stated that corrective action was being taken and that a new program would provide actual use of all RVR, not only in a tower facility.

3. It was recommended that an alternate method be developed to determine runway visibility above the RVR is necessary. This was to be accomplished by alternate runway altitudes, indicated by the Weather Bureau. On Jan. 13, 1962, the FAA stated that this procedure would be implemented on a trial basis in New York, Chicago, and Los Angeles. The Weather Bureau indicated cooperation with the recommendation on Jan. 8, 1962.

4. The Weather Bureau was advised that the status of the Weather Bureau's current status as to the availability of weather reports available to all the weather receiving devices available. On Feb. 1, 1962, the FAA stated that the corrective action would be taken.

5. It was recommended that the Weather Bureau amend their methods of observing and recording prevailing weather when "partial observations" are present. The Weather Bureau indicated cooperation with the recommendation on Jan. 8, 1962.

6. The FAA was informed that there was a period of time on the morning of this accident when no record of tower visibility observations was obtained. It was recommended that the appropriate action should be according and reporting the same values of visibility at all times; and that there should be a written report of all of the visible observations. On Feb. 6, 1962, the FAA stated that operations procedures were being developed to accomplish this end.

7. It was recommended that the "major" portion of weather reports be based on the aircraft. The FAA indicated the Board that a priority report had been issued to provide the transmission of weather information from KTC facilities to all airports as follows:

By the Civil Aviation Board
ALAN S. BURE, Chairman
ROBERT T. MURPHY, Vice Chairman
DAVE GORNEY, Member
C. JAMES MERRITT, Member
WILLIAM C. GILLILAND, Member

SUPPLEMENTAL DATA

Investigation and Hearing

The Civil Aeronautics Board was notified of the accident immediately after its occurrence on May 16, 1962. Twenty-two days thereafter the Board met in session to conduct an investigation to accord with the provisions of Title VII of the Federal Aviation Act of 1958, as amended. A public hearing was held by the Board and held at the International Hotel, New York, New York, on Jan. 24, 1962.

Air Carrier

Eastern Air Lines, Inc., holds a current certificate of public transportation and was used by the Civil Aeronautics Board to appear in the investigation of personal property, and crew. It also presented a valid air carrier operating certificate issued by the FAA.

Flight Personnel

Capt. Edward J. Bickelmeier, age 41, was employed by Eastern Air Lines on Apr. 25, 1961, and had accumulated a total of 15,644 ft. of flight time, of which 2,700 ft. were in DC-7 type aircraft. He held a currently valid FAA pilot certificate, number No. 758120, with numerous ratings, among which were the Douglas DC-7. His last log check in DC-7 aircraft was with a company check pilot on May 15, 1962. The last proficiency check in DC-7 aircraft was on June 16, 1962. Records indicate he satisfactorily passed a first class FAA flight physical on Aug. 27, 1961, without comment.

First John A. Wagner, age 45, was employed by Eastern Air Lines on May 15, 1961, and had accumulated a total of 9,930 ft. of flight time. He had accumulated a total of 3,650 ft. of flight time in DC-7 type aircraft. He was in aircraft command. He held a currently valid FAA pilot certificate, number No. 60075, with numerous ratings, among which were the Douglas DC-7. His last log check was on a Lockheed L-1049 on June 12, 1961. He last proficiency check in DC-7 aircraft was on June 26, 1962. Records indicate he satisfactorily passed a first class FAA flight physical on May 15, 1962, without comment.

First Engineer Robert S. Voshell, age 35, was employed by Eastern Air Lines on Aug. 25, 1957, and had accumulated a total of 4,000 ft. of flight time. He had accumulated a total of 149 ft. as a pilot and was a 718 ft. as a pilot in DC-7 aircraft. He held a currently valid FAA pilot certificate, number No. 1149561. He received his last proficiency flight check on Sept. 17, 1962, which was his required qualification in DC-7 aircraft. Records indicate he satisfactorily passed an FAA second class physical on Feb. 1, 1962, without comment.

Flight attendant Patricia L. Passmore was employed by Eastern Air Lines on Apr. 16, 1962, after completed training on the flight, emergency evacuation and ditching on May 2, 1962, and emergency procedures on DC-677s on May 7, 1962. She satisfactorily passed a company medical examination on Apr. 16, 1962.

Flight attendant Philip J. Richards was employed by Eastern Air Lines on June 16, 1961, after completed training on the flight, emergency evacuation and ditching on June 16, 1961, and emergency procedures on DC-677s on Oct. 30, 1962. She satisfactorily passed a company medical examination on June 16, 1961.

Aircraft
N 111D, a Douglas DC-7B, manufacturer's serial No. 45014, owned and operated by Eastern Air Lines, Inc., 30 Rockefeller Plaza, New York, N. Y., was manufactured in September 1956 and had a total flying time of 14,813.08 hr. at which 203 ft. flying time had accumulated since last major inspection. The aircraft was powered by four Wright model 777C118M40 engines with Hamilton Standard model ME2B 365 propellers. Engine number 1 failed.

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Engine	Type	Hours	Model
1	Wright	14,813.08	777C118M40
2	Wright	14,813.08	777C118M40
3	Wright	14,813.08	777C118M40
4	Wright	14,813.08	777C118M40

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LETTERS

Kennedy Airport

There is no end to the rub of bad times that has afflicted politicians in their search to restore peace and thrice after the late President Kennedy's death. It was a tragedy to change 400 years of American history by wiping out the waters of Capt. Kennedy but new Misses Watson and the New York City Council have hit a new low as efforts to erect a memorial here at the Kennedy Center are being blocked by the Kennedy family. The Kennedy designation was to honor the late Mr. John F. Kennedy Jr. and his family, a World War I combat hero who died of a heart attack in 1941 while commanding an aircraft division in training for World War I. Even though the graying of the Kennedy Center is a tragedy, it is a shameful trick to throw John Anderson's memorial out of the way to supersede that of the late President Kennedy.

New York, N.Y.

TFX 'Damage'

The competitive bidding process has been disrupted by the collapse of one of the TTX contracts.

The British government was almost brought down.

[illegible]D. W. BARNWORTH
Los Angeles, Calif.

Fowler Flap

Yves Nov 4 umc has an excellent article on the Boeing 717 production program (p. 50) which showed numerous photographs of the remarkable lay-out of the factory and which was adapted in the version reported by Mr. C. M. Fournier.

I feel confident his Platters and most of American WYSE & SARGENT TECHNOLOGIES selected staff are aware that the flap described in this article is the Fowler flap. It is interesting to note that credit is given to the Kneisel flap several times. The very German sensation which was not perceived in this country. It was wondering the re-

Action: *Ward welcomes the opinions* of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, *Quackenbush*, 130 W. 42nd St., New York 36, N. Y. To keep letters under 500 words and give a genuine identification. If's will not print anonymous letters, but names of writers will be withheld on request.

can the credit being given to the Knicker Boy and not the Fowler Boy. Can it be that having it being so simple to the public that my Boy is a special development of their own commitment?

The photos of the "T" key show long external bristles under the wing, first used on the Martin Fairchild F-21 in 1934, which indicates the variable cam feature which is the basis of my Patent No. 1,673, 357 issued May 22, 1928.

In addition, the photos show a lateral control system using spacers and rollers on the flap that was first used on the Ryan Dragonfly in 1940 and applied to full size Fowler flaps. Also visible on the flap and outboard trailing edge of the wing were fasteners used on the Consolidated Model 51 airplane.

All three features and numerous others were featured in my book, *"The Fiesler Fly"*, published in 1946. It is a manual, a handbook on design and aerodynamics, as well as on historical development and construction, distributed. This is an invention that goes back to 1916 and book 21, 1935, before the present concept was finally adopted in the Lockheed Model 14 two-manal transport.

It should be made clear that all my 75 letters except those, and all those mentioned since the patent expired in 1945, have committed me as to the facts which I used on their secrets and am commencing to do so even after 10 years since my patent expired. And for this recognition I humbly express my thanks.

The list of the independent variables is a long and somewhat, a familiar job in the Space Age effort calling basically for new ideas to place this country in the forefront: it is the individual's role imagination and courage of conviction who have made these contributions in its progress. It is not the companies nor the government who make these contributions, for patents protecting ideas are issued only to the inventor; rather he is a private citizen or an employee of an organization.

No doubt, there are breakdowns—perhaps thousands of revolutions going on, including commanding contributions in the Space Age effort whose name will never touch the printed page of recorded history. The reason for this is that these inventors are in the employ of electronics, aerospace, industrial, governmental or work in the aircraft engine and engine manufacturers. Consequently, they are obliged to keep all their ideas in a perpetual state of employment. It is a very serious barrier, because it is limited and because the best contribution developed while in the employ of an organization engaged on government contracts.

The military and the Congress have grappled with this problem but as far as I know,

been unable to do anything about it. There is a conspiracy in our American way of life that needs to be unmasked. Therefore, it seems only fitting that American Women Space Technicians make every effort to recognize the inventor by name and give credit even when others fail to do so.

Harriet D. Fennell

Barlingo, C&M
 (Barling actually acknowledges that the Fowler concept of leading edge wing extension is the basis for the 720 flap design but points out that some 50 different configurations were proposed in its own staff before settling on the implemented flap actually used. The implemented design is a low cut down the engineering road from the original Fowler flap—C&M)

Zimmerman Idea

The price of the personalized design for a custom-imagery aircraft as the No. 25 *Warrior* Wings & Struts. Customers to fill in the blanks to send a design to the artist. The artist then chooses the colors and the aircraft is painted. The aircraft is then flown to the customer's home. The aircraft is then flown to the customer's home. The aircraft is then flown to the customer's home.

The Navy sponsored the excellent design. Whatever happened to it? I suspect it was killed off by "conventional" people who placed the same growing pain of rejection in "conventional" attitudes designed by "conventional" people. I hope the lessons about some funding on the Navy's part; they spent the money on Zumwalt's idea and flew a hot ball as well as a full-scale prototype. Why not revitalize the Zumwalt design? It may be that the answer to that question is in the Navy's files.

W. DONALD KORTZ
Boulderport, Colo.

(Reader Korte is referring to Charles H. Zimmerman's *Chance Vought XP3U* [ATJ Jan 2, 1993 p 28]. Zimmerman himself, a Chance-Vought aircraft designer later director of structural research for National Aeronautics and Space Administration, is now chief engineer for Avco Material Company—ED).

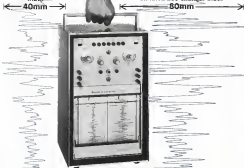
U.S. Jet Dominance

If then, a more significant event is Mr John H. Potts attack on the management of U.S. airlines and airline facilities (NYT, Nov. 21, p. E20) perhaps he can replace the dominant position of U.S. commercial jet aircraft in the international market and the high risk of development of the U.S. air transport system.

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